# COMPARISON OF INTRATHECAL LEVOBUPIVACAINE AND LEVOBUPIVACAINE WITH FENTANYL IN CAESAREAN SECTION - A RANDOMISED TRIAL

**Dissertation submitted to**
**The Tamil Nadu Dr. M.G.R.**
**Medical University,**
**Chennai – 600032**

**With fulfilment of the regulations**
**for the award of Degree**

**M.D.ANAESTHESIOLOGY**
**BRANCH – X**


**DEPARTMENT OF ANAESTHESIOLOGY**
**K.A.P.V. GOVT. MEDICAL COLLEGE,**
**TRICHY.**

**APRIL 2015**

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This is to certify that this dissertation titled **"COMPARISON OF INTRATHECAL LEVOBUPIVACAINE AND LEVOBUPIVACAINE WITH FENTANYL IN CAESAREAN SECTION – A RANDOMISED TRIAL"** is a bonafide work of **DR.ASHA.A**.., Post Graduate in M.D.Anaesthesiology, Department of Anaesthesiology, K.A.P.V. Government Medical College, Trichy and has been prepared by her under our guidance. This has been submitted in partial fulfilment of regulations of The Tamil Nadu Dr. M.G.R. Medical University, Chennai -32 for the award of M.D. Degree in Anaesthesiology.

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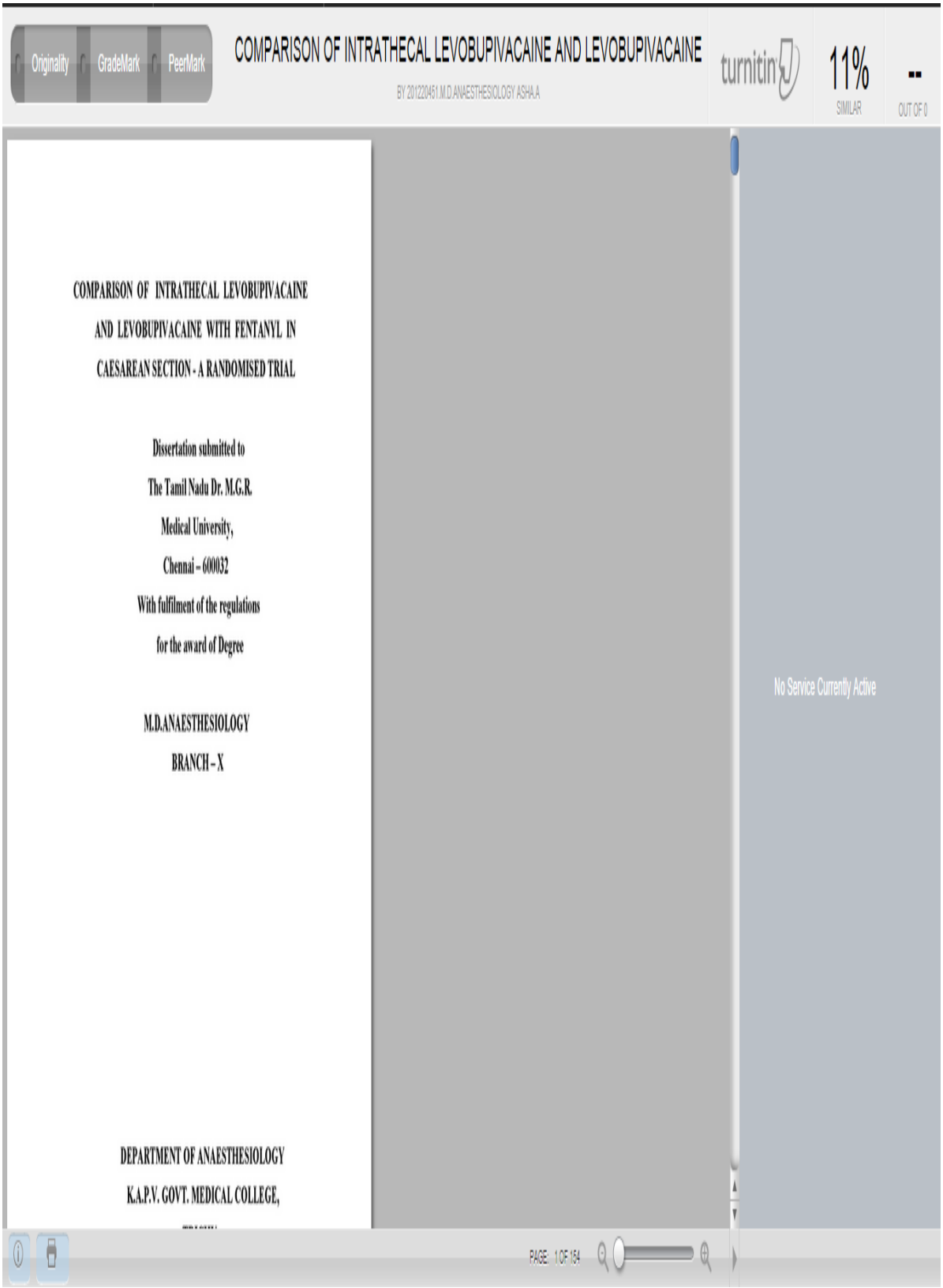
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# ABBREVIATIONS

| | | |
|---|---|---|
| ASA | - | American society of Anaesthesiologist |
| BIS | - | Bispectral Index |
| CSF | - | Cerebrospinal Fluid |
| FRC | - | Functional Residual Capacity |
| GIT | - | Gastrointestinal Tract |
| IVC | - | Inferior Vena Cava |
| IVS | - | Intervertebral Space |
| MAP | - | Mean Arterial Pressure |
| NMDA | - | N-Methyl d-Aspartate |
| PACU | - | Post Anaesthesia Care Unit |
| PDPH | - | Post Dural Puncture Headache |
| TNS | - | Transient Neurological Syndrome |

## ABSTRACT

**Title:** Comparison of intrathecal levobupivacaine and levobupivacaine with fentanyl in caesarean section.

**Introduction:** Spinal anaesthesia provides rapid onset and dense neural blockade for caesarean section [(1)]. The use of small doses of local anaesthetic with or without opioids, results in little local anaesthetic toxicity and minimal transfer of drugs to the placenta. Hyperbaric bupivacaine is the most commonly used local anaesthetic agent intrathecally for this purpose. Fentanyl has prolonged post operative analgesia when administered with bupivacaine intrathecally for caesarean section. There are enormous studies conducted to compare bupivacaine with and without fentanyl in caesarean section, but limited for levobupivacaine. Hence we decided to compare plain levobupivacaine and levobupivacaine with fentanyl in patients undergoing caesarean section.

**Aims and objectives:**

1) To compare the onset and duration of sensory and motor block, following intrathecal levobupivacaine and levobupivacaine with fentanyl in patients undergoing elective caesarean section.
2) To compare hemodynamic changes, level of sedation, apgar score and postoperative analgesia, following intrathecal levobupivacaine and levobupivacaine with fentanyl administration.

**Material and method:**

This prospectively designed randomised controlled study was done after getting approval from Ethical committee of Mahatma Gandhi Memorial Government hospital. 80 patients were randomly divided into two groups of 40 each. Those weighing more than 80 kg, with height < 150cm, coagulopathy, spinal disorders, uterine anomaly, were excluded from the study.

Randomly patients were assigned into two groups, by computer generated random allocation numbers.

- Group L (n=40) received injection levobupivacaine. 0.5% Levobupivacaine 10mg was combined with 0.3 ml of normal saline, with the total volume of injectate was 2.3ml.
- Group LF (n=40) received levobupivacaine with fentanyl. 0.5% Levobupivacaine 10mg was combined with 0.3ml (15microgram) of fentanyl, with the total volume of injectate was 2.3ml.

**Results:** Addition of fentanyl significantly increased the time for rescue analgesia requirement (group L: 132.70±8.058; group LF: 179.90±6.953) and two segment regression time (group L: 78.55±13.399; group LF: 95.60±6.559). Sensory onset time ( group L: 4.38±.490; group LF: 2.28±.452), motor onset time( group L: 5.75±.840; group LF: 2.70±.464) and motor recovery time (group L: 152.75±9.407; group LF: 116.33±4.543) were shortened. Neonatal outcome assessed by apgar were comparable in both groups.

**Discussion and conclusion:**

Addition of intrathecal fentanyl 15µg to 10 mg of 0.5% levobupivacaine in caesarean section shortens the onset of sensory and motor block, prolongs the duration of postoperative analgesia with early motor recovery. Incidence of pruritus, hypotension, nausea and vomiting were relatively high in levobupivacaine with fentanyl group. There was no statistical difference in terms of hemodynamic variables between both groups. Neonatal wellbeing was the same in both groups.

**Key words:** levobupivacaine, fentanyl, bupivacaine, Spinal anaesthesia, caesarean section, post operative analgesia.

# INTRODUCTION

Spinal anaesthesia provides rapid onset and dense neural blockade for caesarean section [1]. The use of small doses of local anaesthetic with or without opioids, results in little local anaesthetic toxicity and minimal transfer of drugs to the placenta. Hyperbaric bupivacaine is the most commonly used local anaesthetic agent intrathecally for this purpose.

Levobupivacaine, an S(-) enantiomer of bupivacaine possess less cardiovascular toxicity and long duration of action and, clinical profile is similar to bupivacaine. In many animal and human volunteer studies, the safety of levobupivacaine has been evaluated and is comparable to racemic bupivacaine. On inadvertent intravascular injection, the lethal dose of levobupivacaine was 1.3- to 1.6- fold higher than that of bupivacaine.

Spinal adjuvants like epinephrine, morphine, and either fentanyl or sufentanil have been demonstrated to improve the quality of spinal anaesthesia. Since fentanyl has been proven to be a safe drug when administered intrathecally for caesarean section by several studies and easily available at our institution, it was chosen for the study. Fentanyl has prolonged post operative analgesia when administered with bupivacaine intrathecally for caesarean section.

There are enormous studies conducted to compare bupivacaine with and without fentanyl in caesarean section, but limited for levobupivacaine. Hence we decided to compare plain levobupivacaine and levobupivacaine with fentanyl in patients undergoing caesarean section.

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1) To compare the onset and duration of sensory and motor block, following intrathecal levobupivacaine and levobupivacaine with fentanyl in patients undergoing elective caesarean section.

2) To compare hemodynamic changes, level of sedation, apgar score of neonate and postoperative analgesia, following intrathecal levobupivacaine and levobupivacaine with fentanyl administration.

# HISTORY

# HISTORY

In 1847, James simpson [(2)], an obstetrician, used chloroform widely for parturients during labor and advocated the use of analgesics during parturition. Regional anaesthetic technique became popular slowly for caesarean section, as a result of strong criticism from obstetricians who raised the question of safety of chloroform in parturients. Regional anaesthesia has several advantages such as, reduced risk of aspiration and failed intubation, retention of maternal consciousness to enjoy the childbirth, in the absence of depressant drugs.

# ANATOMY

# ANATOMY

Vertebral bones [3] and fibrocartilaginous intervertebral disc forms the skeletal framework of spine with 7 cervical, 12 thoracic, 5 lumbar, 5 fused sacral and 4 fused coccyx vertebra. Spinal cord is enclosed within the vertebral column and is continuous cephalad with brainstem through foramen magnum and terminates at the level of L1 in adults. The spinal cord tapers into conus medullaris from which filum terminale arises to attach to coccyx.

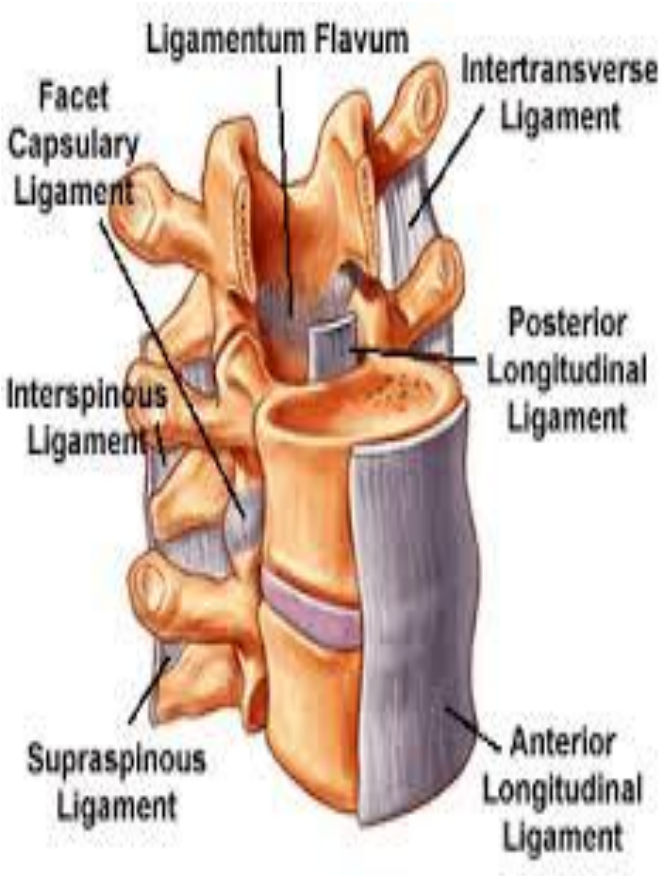



**Figure 1. Vertebral anatomy**

Four synovial joints exist in each vertebra, each pair articulating with vertebra above and below. Anteriorly, the vertebral bodies are supported by anterior and posterior longitudinal ligaments. Posteriorly, the spinal cord is supported by ligamentum flavum, interspinous ligament and supraspinous ligament, through which the spinal and epidural needle enters the interlaminar space to pierce the meningeal layer to reach the subarachnoid and epidural space respectively.

The lower spinal nerve roots traverse some distance before exiting the intervertebral foramen,as the spinal cord ends et L1.It is called cauda equina. The spinal cord is surrounded by duramater, arachnoid mater and piamater, from outer to inner. Duramater extends from foramen magnum to S2. Epidural space lies outside duramater, while subarachnoid space is between arachnoid and pia mater. Subdural space lies between dura and arachnoid mater.

Spinal cord [(4)] is supplied by single anterior spinal artery and two posterior spinal arteries. Subarachnoid space contains cerebrospinal fluid, spinal nerves, incomplete posterior subarachnoid septum, ligamentum denticulatum.

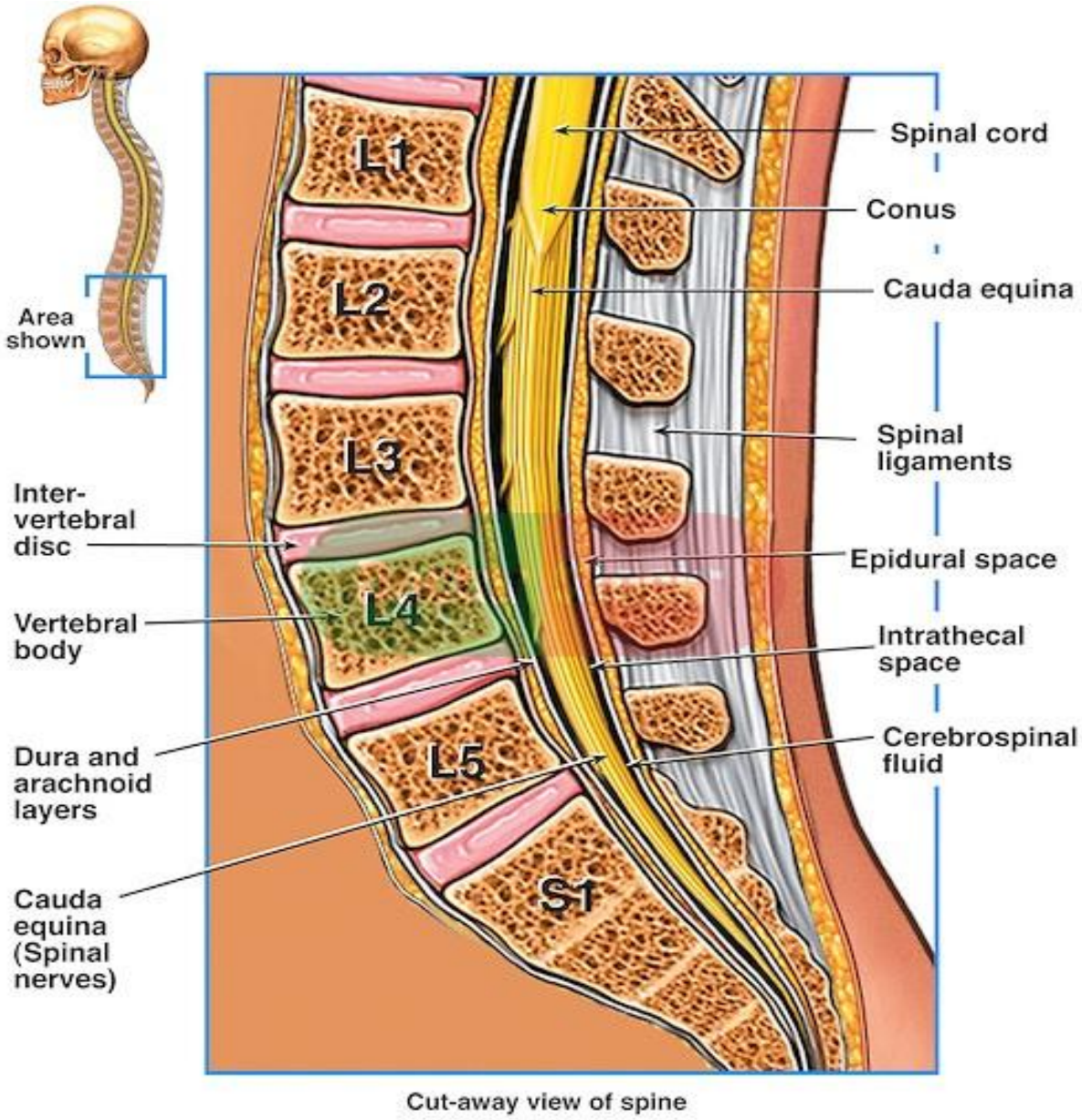



**Figure 2. Sagittal section of spinal cord.**

**Anatomical changes of pregnancy affecting regional anaesthesia:**

Softening and hypodensity of perivertebral ligaments including ligamentum flavum during pregnancy, may make the appreciation of passage of epidural needle through the ligamentum flavum difficult. During positioning for neuraxial blockade administration, it is difficult for the pregnant women to achieve maximum lumbar flexion due to exaggeration of physiological lumbar lordosis.

Following changes are noted in the vertebral column:

1. Rotation [5] of the pelvis on the long axis of the vertebral column shifting the imaginary line joining the iliac crest cephalad to the vertebral column.

2. Narrowing of the interspinous space in the lumbar region may make the administration of neuraxial technique difficult.

3. There is reduction of thoracic kyphosis with shifting caudal of apex of lumbar lordosis, making the spread of intrathecal local anaesthetic solutions unpredictable in supine posture.

**Following structural changes are noted in the spinal cord during pregnancy:**

1. Engorgement of epidural veins caused by IVC compression by enlarging gravid uterus may cause intravascular injection of local anaesthetic during epidural administration.
2. Enlarged epidural space reduces subarachnoid space volume, thereby reducing the local anaesthetic requirement during spinal anaesthesia.
3. Low specific gravity of CSF alters the spinal local anaesthetic requirement.

# PHYSIOLOGY

**Physiology**

Uterine contractions during the first stage of labor resulting in myometrial ischemia releases histamine, bradykinin,serotonin. Mechanoreceptors are stimulated by stretching and distension of lower uterine segment and cervix. These two noxious impulses are carried by sensory nerve fibers accompanying sympathetic nerve endings entering the spinal cord at T10 to L1 spinal segments. Stretching of the perineum at second stage of labor are carried by pudendal nerve to S2 to S4 spinal segments.

Though the incision in lower segment caesarean segment is below the umbilicus, sensory level of blockade of T4 to T5 is required for a painless caesarean delivery.

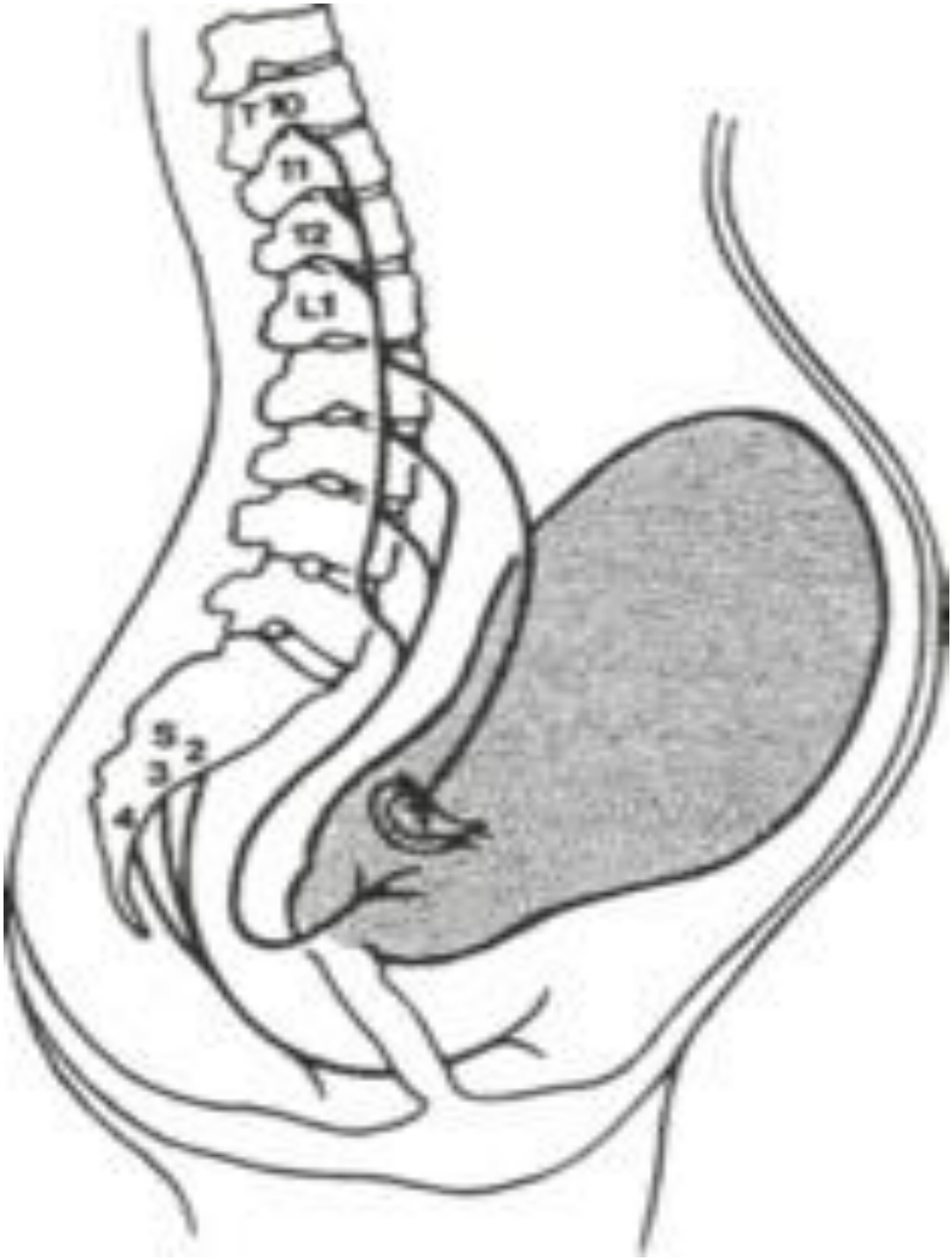


**Figure 3. Nerve supply of Uterus.**

**Physiology of neuraxial blockade:**

Local anaesthetic agents block sodium channels along nerve membrane producing nerve blockade. Differential block is noted with spinal rather than with epidural block due to direction action on nerve fibres by local anaesthetic in spinal anesthesia. Block regression is explained by uptake of local anaesthetic by blood vessels in subarachnoid space and spinal cord.

Systemic effects of regional anaesthesia[6]:

1. **RESPIRATORY FUNCTION:**

   In parturients, the functional residual capacity is reduced due to cephalad movement of diaphragm by increased intra abdominal pressure and posing a risk of hypoxemia. Supine posture after regional anaesthesia decreases the FRC further, increases minute ventilation and oxygen consumption, hence easily prone for hypoxemia.

   External intercostal muscle paralysis seen in high spinal does not affect respiration. Abdominal muscle paralysis during regional anaesthesia decreases peak expiratory flow rate and coughing ability.

## 2. CARDIOVASCULAR SYSTEM:

Supine hypotension syndrome in pregnancy is a major concern in regional anaesthesia, which becomes severe after regional anaesthesia. It is prevented by adequate preloading, wedge placement underneath the right buttock region. Aortocaval compression leads to shunting of blood through intraosseous vertebral veins, paravertebral and epidural venous plexus, reducing subarachnoid space volume secondary to increased epidural pressure. This compression is seen as early as 13 to 16 weeks of gestation and reaches maximum by term.

In early trimester, the systolic blood pressure falls due to aortic dilation and diastolic fall is due to reduced vascular resistance. Subsequently, the blood pressure is maintained by the increased sympathetic drive which is cut off by regional anaesthesia, leading to exaggerated fall of blood pressure.

## 3. OTHER SYSTEMS:

In the GIT, the gravid uterus shifts the stomach cephalad altering the gastro esophageal junction and the circulating progesterone reduces the lower esophageal sphincter tone., placing the parturient at high risk of aspiration of gastric contents.

## 4. UTERINE BLOOD FLOW AND REGIONAL ANAESTHESIA:

Pain, stress and hyperventilation decreases uterine blood flow by sympathetically mediated release of norepinephrine and epinephrine. This leads to abnormal fetal heart rate patterns. Pain relief by regional anaesthesia decreases these catecholamines and thereby increases uterine blood flow.

## 5. OXYGEN CONSUMPTION:

Consumption of oxygen increases by 30% to 40% during pregnancy accompanied by parallel increase in carbondioxide production. This is due to increased metabolic requirement by gravid uterus, fetus, placenta and increased cardiac output. Hence oxygen supplementation is a must during regional anaesthesia.

**Physiology of CSF.**

CSF is produced by the choroid plexus of cerebral ventricles to a volume of 150 ml per day. 50% of CSF is present within the cranium while 50% lies within the subarachnoid space. It is produced at a rate of 550ml/day with a turn over of 3.7 times a day. CSF that is formed in the ventricles flows through the foramen of Magendie and Luschka[7] to the subarachnoid space and is reabsorbed by arachnoid villi projecting into cerebral sinuses.

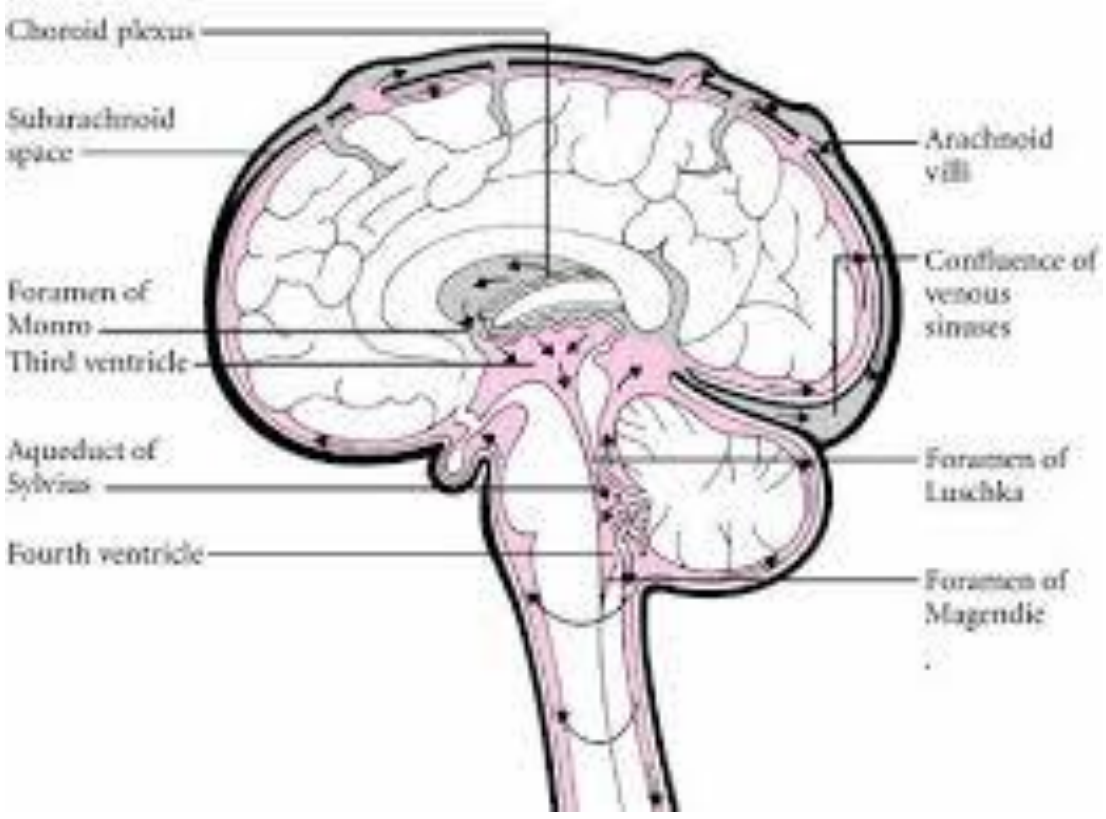



**Figure 4. CIRCULATION OF CSF.**

**Properties of cerebrospinal fluid:**

| | | |
|---|---|---|
| CSF pressure | - | 50 to 180cmH2O |
| pH | - | 7.33 |
| Protein | - | 15 to 45 mg/dl |
| Glucose | - | 40 to 85mg/dl |
| Lactate | - | <35mg/dl |
| LDH | - | $1/10^{th}$ of serum concentration |
| Specific gravity | - | 1.006 |

Specific gravity is defined as the ratio of density of one solution to the density of water.

Baricity is defined as the ratio of density of one solution to the density of another.

If the specific gravity of a solution is greater than the specific gravity of CSF, it is considered to be hyperbaric, and if lesser than the specific gravity of CSF, it is considered to be hypobaric. A solution is made hyperbaric by adding dextrose while it is made hypobaric by adding sterile water.

# PATHOPHYSIOLOGY OF ACUTE POSTOPERATIVE PAIN

**Pathophysiology of acute postoperative pain[9]**

Management of pain is an important aspect of anaesthetic management of patient. If pain is not appropriately managed, it increases morbidity of patients by exerting adverse effects on all organ system in the body. Neuroendocrine response to pain mediated by efferent limb of pain pathway is directly proportional to intensity of pain.

**1) Cardiovascular system:**

Pain produces tachycardia, hypertension, increased myocardial workload. There is increase in cardiac output, thereby increasing myocardial oxygen demand. This is met in a patient with normal ventricular function but not in patients with poor function. Therefore pain may precipitate myocardial ischemia.

**2) Respiratory system:**

There is increase in minute ventilation and therefore of work of breathing due to increased oxygen consumption and carbon dioxide production induced by untreated pain. Abdominothoracic incisions impairs respiratory movements by guarding, resulting in reduction of functional residual capacity, tidal volume, leading to atelectasis, shunting and hypoxemia, impaired coughing and clearing of secretions.

**3) Gastrointestinal and genitourinary system:**

Sympathetic activation by pain leads to increased sphincter tone, impaired urinary and intestinal motility, hypersecretion of gastric juice. Collectively the patient is placed at risk of ileus, urinary retention, stress ulceration, aspiration pneumonia, nausea, vomiting. Resulting abdominal distension further impairs lung function.

**4) Endocrine system:**

Catabolic hormones like catecholamines, cortisol, glucagon increases leading to hyperglycemia, lipolysis, negative nitrogen balance, expansion of extracellular volume.

**5) Haematological and immune system:**

There is increased platelet adhesiveness, hypercoagulability, impaired fibrinolysis placing the patient at risk of deep vein thrombosis and pulmonary embolism, when coupled with prolonged immobilisation. Depression of reticuloendothelial system results in infection.

Surgery and the resulting untreated pain produces anxiety, insomnia and if untreated may place the patient at risk of permanent psychological damage.

**Benefits of post operative pain management:**

1) Decreases pulmonary and cardiac workload, thereby maintains myocardial function and oxygenation.
2) Reduces the incidence of deep vein thrombosis due to early ambulation.
3) Improved bowel and bladder movements preventing urinary retention and promoting early enteral feed.
4) Reduction of neuroendocrine stress response.
5) Early recovery and decreased hospital stay.

# PHARMACOLOGY

# PHARMACOLOGY

## LEVOBUPIVACAINE

Levobupivacaine[10] is a long acting amide type local anaesthetic agent. It is an S(-) enantiomer of racemic bupivacaine with less cardiovascular and central nervous system toxicity.

Chemical structure of levobupivacaine:

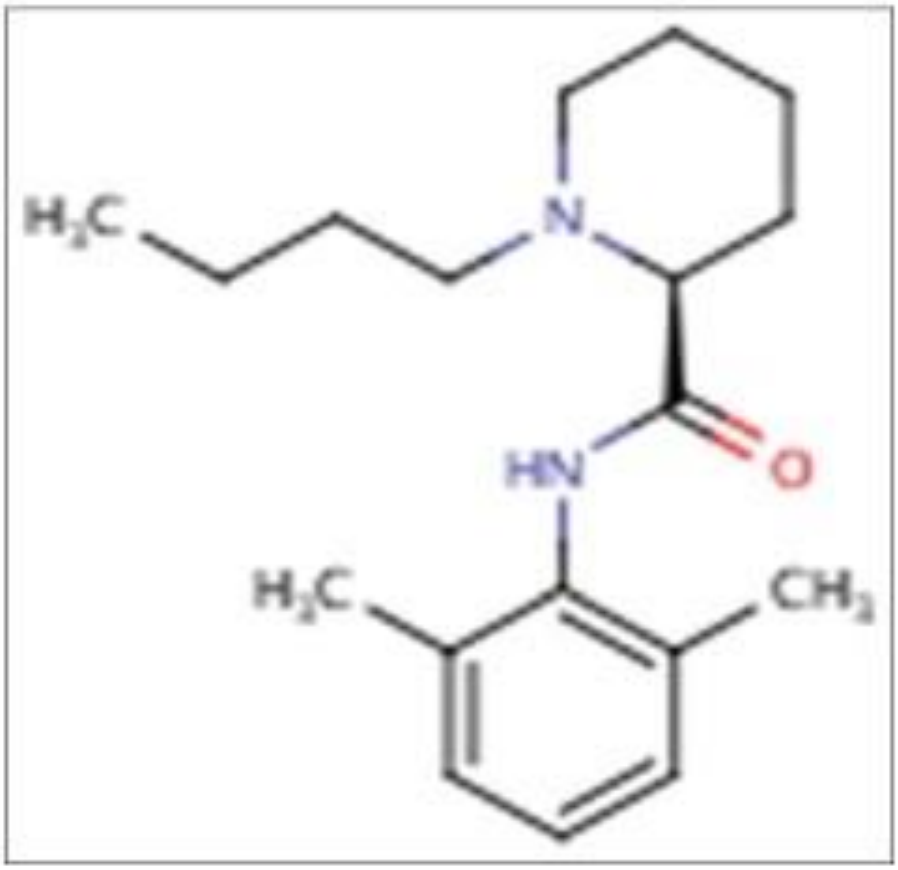



**Figure 5. CHEMICAL STRUCTURE OF LEVOBUPIVACAINE**

Levobupivacaine ([2S]-1-butyl-N- [2, 6-dimethylphenyl] piperidine-2-carboxamide) is an amino-amide local anesthetic drug belonging to the family of n-alkyl substitute pipecoloxylidide. Its chemical formula is $C_{18} H_{28} N_2 O$.

**Mechanism of action**

Levobupivacaine reversibly blocks neuronal sodium channels and thereby blocks nerve conduction. Myelinated and small diameter nerve fibers are blocked rapidly than others.

**Pharmacokinetics**

Levobupivacaine is metabolised by CYP3A4 and CYP1A2 isoform to inactive metabolites, des butyl levobupivacaine and 3-hydroxy levobupivacaine respectively. 3-hydroxy levobupivacaine is further conjugated with glucuronic acid and sulphate. The conjugates are excreted in urine.

pKa of levobupivacaine is 8.1. Its half life is 157 minutes.

**Dose**

Minimum effective local anaesthetic dose is 11.7mg for subarachnoid block.

Spinal anaesthesia for caesarean section-dose is 7.5 to 15mg.

**Safety issues**

Protein binding of levobupivacaine to acid alpha-1 glycoprotein is 97% whereas that for racemic bupivacaine is 95%. Less than 3% is available free in plasma to act on other tissues causing unwanted side effects unlike bupivacaine.

D-isomer is more potent and faster in blocking inactive sodium channels than L-isomer, explaining the higher cardiotoxicity associated with the D-isomer.

Safety margin is 1.3, which means that toxic effects are not seen until concentration rises by 30%. With UV:MA(feto maternal) ratio of 0.3 in pregnant women, levobupivacaine crosses the placenta following 30ml of 0.5% levobupivacaine administration into epidural space in caesarean section.

**Pharmacodynamics of local anaesthetic agent in pregnancy**

1) During pregnancy, there is enhanced neuronal sensitivity to local anaesthetic agents, probably owing to hormonal and biochemical changes of pregnancy.
2) Mechanical effect of engorged epidural veins over subarachnoid space volume reduces the dose of local anaesthetic drug.
3) Higher bicarbonate, pH and lower carbon dioxide content of CSF provides more free base form of local anaesthetic agent to diffuse across nerve membranes.

**Spinal adjuvants**

Adjuvants are drugs combined with local anaesthetic agents with the aim of increasing the density of block, reducing local anaesthetic drug quantity and therefore its unwanted side effects like hypotension, bradycardia. Prolongation of postoperative analgesia and early reversal of motor blockade, with the addition of adjuvants is desirable, especially for early ambulation and day care surgeries.

Following are commonly used adjuvants:

- Opioids
- Alpha-2 adrenergic agonist
- NMDA receptor antagonist
- Gabapentin
- Vasoconstrictor like epinephrine
- Corticosteroids
- Benzodiazepines like midazolam
- Anticholinergics like neostigmine

**Opioids**

Opioids are compounds related to opium. Classified as

1) naturally occurring eg: morphine
2) semisynthetic compounds eg: diamorphine
3) synthetic compounds eg: fentanyl

**Fentanyl**

Molecular structure of fentanyl:

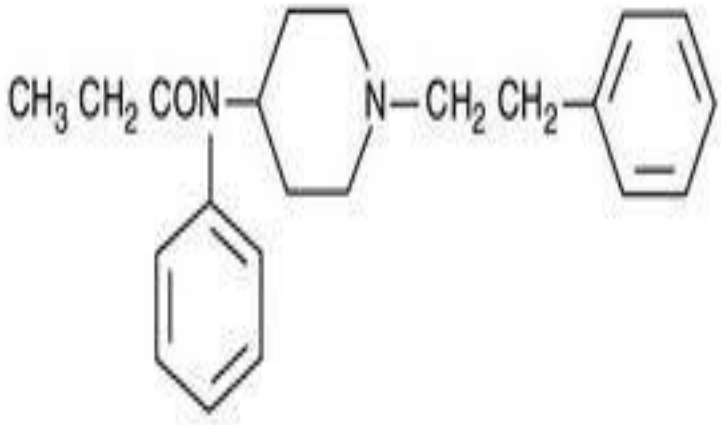



**Figure 6. CHEMICAL STRUCTURE OF FENTANYL.**

Fentanyl[11] is a phenylpiperidine derivative with 75 to 125 times more potency than morphine.

**Pharmacokinetics**

The greater lipid solubility and rapid redistribution of fentanyl is responsible for its rapid onset and short duration of action. Apart from fat and skeletal muscles, lung serves as an important inactive storage site for fentanyl with 75% initial dose undergoing pulmonary uptake.

It is metabolised by N-demethylation in liver to norfentanyl, hydroxy propionyl-fentanyl, hydroxypropionyl-norfentanyl with norfentanyl being an important metabolite, excreted by kidneys.

It has longer elimination half time despite short duration of action, owing to large volume of distribution due to high lipid solubility. It is 79% to 87% protein bound.

**Mechanism of action**

Fentanyl acts at mu opioid receptor. Drug receptor interaction inhibits presynaptic release of excitatory neurotransmitter and also inhibits postsynaptic sensitivity to such neurotransmitter released from nociceptive neurons.

Site of action of opioids at spinal cord is substantia gelatinosa of lateral horn of gray mater, though the receptors are distributed within the central nervous system, somatic and sympathetic peripheral nerves.

**Clinical uses:**

- ❖ Fentanyl at a dose of 1-2µg/kg IV provides analgesia.
- ❖ At a dose of 2-20µg/kg IV along with inhaled anaesthetics, it blunts stress responses to laryngoscopy and altering surgical stimulation.
- ❖ Dose of 50-150µg/kg IV is employed for surgical anaesthesia.
- ❖ Intrathecal fentanyl 25µg for effective labor analgesia.
- ❖ Oral transmucosal fentanyl 15-20µg/kg in pediatric age group 45 minutes preoperatively provides sedation and allows smooth inhalational induction.

| | | |
|---|---|---|
| Intrathecal single dose | : | 5-25µg |
| Epidural single dose | : | 50-100µg |
| Epidural continuous infusion | : | 25-100µg/hr |

**Side effects**

- Chestwall rigidity
- Bradycardia
- Neuroexcitatory phenomena- seizure activity
- Pruritus
- Early Respiratory depression(<6hour)
- Nausea and vomiting
- Reflex coughing

**Neuraxial fentanyl**

Neuraxial fentanyl has 5-10 minutes of onset of action with a duration of 2-4 hours, with minimal CSF spread. The effect is due both to spinal and systemic effects.

**Opioids in obstetrics**[11].

**Maternal effects**.

Spinal opioid effects on mother is determined by molecular weight and lipid solubility of the drug. Our main concern is respiratory depression.

Highly lipid soluble drugs like fentanyl, sufentanil reach systemic circulation and spinal cord earlier to produce respiratory depression by acting on medullary respiratory centre. This is manifested within two hours of intrathecal administration of the drug, called early respiratory depression.

Hydrophilic opioids like morphine, hydromorphone takes longer time to reach systemic circulation and more drugs remain in CSF, to produce late respiratory depression at more than two hours, characteristically at 6-12 hours but not more than 24 hours.

With the use of small dose of lipid soluble fentanyl, maternal respiratory depression is unseen coupled with effective monitoring.

**Fetal and neonatal effects**.

With the usage of small dose of neuraxial opioids, apgar scores, umbilical cord blood gas and pH measurements are better at delivery.

Fetal bradycardia is sometimes observed not due to direct effect of opioids. Adding opioids gives effective pain relief, which decreases maternal epinephrine. Epinephrine has tocolytic effect acting on uterine beta 2 receptors. Reduced epinephrine and unchanged norepinephrine results in uterine hypertony. This compromises uteroplacental perfusion and foetal status. Also postulated is that the lipid soluble opiods produce central effects, altering oxytocin and vasopressin release, leading to uterine hyperactivity.

# REVIEW OF LITERATURE

# REVIEW OF LITERATURE

**Loftus et al**[13] compared transplacental transfer of opiods, fentanyl and sufentanil administered with bupivacaine for labour analgesia. Modest reduction in terms of neurologic and adaptive capacity scores at 24 hours of age were noted among babies born to mothers who had received epidural fentanyl, while only one umbilical arterial blood sample showed sufentanil.

**Hamdy M.Shokr et al**[14] evaluated the effect of fentanyl on alertness level of patients who underwent lower limb orthopaedic surgery. 60 patients were randomly divided into two groups of 30 each. Control group received 12.5mg of hyperbaric bupivacaine with 0.5ml of normal saline intrathecally. Study group received 12.5mg of hyperbaric bupivacaine with 25microgram fentanyl intrathecally. Baseline mean arterial pressure, bispectral index, modified observer assessment for alertness/ sedation score(MOAA/S) were recorded.

After spinal anaesthesia with study drug, MAP, BIS, MOAA/S were evaluated every 5 minutes for 90 minutes. Sensory block was assessed at 5, 10, 15, 20 and 30 minutes after spinal block and patient satisfaction assessed at the end of surgery. There was a progressive decrease in BIS and MOAA/S in fentanyl group. BIS decreased

significantly at 30-65 minutes and MOAA/S decreased significantly at 20-80 minutes after spinal anaesthesia. No significant difference was found in mean arterial pressure and sensory block height. They concluded that fentanyl added to bupivacaine reduced the alertness level and produced a consistent sedative effect than a single dose of bupivacaine alone.

**Kenneth E Nelson et al**[15] evaluated the ED50 of intrathecal fentanyl for 60minutes of labor analgesia to establish intrathecal potency ratio for fentanyl and sufentanil. Then, the same study group is subjected to compare the efficacy, duration of analgesia and side effects of intrathecal sufentanil and fentanyl for labor analgesia. 75 parturients were divided into 20 and 55 patients. 20 patients were subjected to receive varying doses of fentanyl to evaluate the ED50 for intrathecal fentanyl for 60 minute labor analgesia. 55 patients either received 36microgram intrathecal fentanyl or 8microgram intrathecal sufentanil through combined spinal epidural technique.

Variables like duration of analgesia, degree of pain relief, maternal hemodynamics, block height, foetal heart rate were compared. It was concluded that the ED50 of intrathecal fentanyl for 60 minute labor analgesia was 18.2µg and that the potency ratio for sufentanil and

fentanyl intrathecally was 4.4:1. Duration of analgesia was longer in sufentanil group than fentanyl group. Others like maternal hemodynamics, foetal heart rate, mode of delivery duration of labor, side effect profile, visual analogue scores, apgar score were comparable between the two groups.They concluded that using sufentanil for labor analgesia increased its duration by 25 minutes, without significant side effects.

**Reynolds et al**[16] studied epidural opiod analgesia against systemic opiod analgesia. In 2102 parturients better umblical cord acid base measurements was seen among epidural analgesia than systemic opiod analgesia, thus suggesting that epidural opioid analgesia not only produces superior analgesia but also reveals a better neonatal outcome.

**Shahriari A et al**[17] designed this study to evaluate the efficacy and safety of intrathecal fentanyl. 40 parturients who were to undergo elective caesarean section were divided into 40 each, to receive either 80mg of 0.5% lidocaine with 15µg fentanyl or 80mg of 0.5% lidocaine with 2.5ml of 0.9% normal saline as control.

Maternal hemodynamics, sensory and motor block characteristics, neonatal assessment was done in both groups. Maternal hemodynamics were monitored at 2 minute interval until delivery, at 5 minute interval

until discharge from recovery. The duration of sensory block in terms of duration of complete and effective analgesia were prolonged in fentanyl group. Motor block duration were shorter in fentanyl group. It was concluded that adding fentanyl to lidocaine improves the quality of analgesia without producing maternal and neonatal side effects.

**Gonzalez et al**[18] studied the prevalence of respiratory depression in neonates born to mothers who underwent caesarean section under spinal anaesthesia involving fentanyl.

It was a cross sectional analytical observational retrospective study of 2165 caesarean section with the usage of mean dose of 19.21 mcg of intrathecal fentanyl. Apgar < 7 and apgar < 4 were considered as low and severe apgar respectively. Low apgar prevalence at 1, 5, 10 minutes were 1.77%, 0.11% , 0% respectively. Severe apgar prevalence at 1, 5, 10 minutes were 0.059%, 0%, 0% respectively. No significant difference was noted by ANOVA analysis. The conclusion was that prevalence of respiratory depression as measured by apgar was low and the reliability of this assessment is doubtful.

**Dilek et al**[19] conducted a randomised controlled trial to study the effect of adding lidocaine on the duration of hyperbaric levobupivacaine in patients undergoing transurethral resection of prostate(TURP). 40 patients were randomly divided into two groups of 20 each. Each group received either 6.75mg levobupivacaine + 0.3ml of 2% lidocaine (group L) to volume of 1.8ml or 6.75mg levobupivacaine with saline (Group C) to the same volume of 1.8ml intrathecally. Duration of spinal block, PACU stay, sensory and motor block characteristics, adverse events, treatment given were monitored in both groups.

Sensory and motor block resolved faster in group levobupivacaine with lidocaine. Duration of stay at PACU is also shorter in group L. Both the groups were comparable with respect to complications. No PDPH or TNS were noticed in either group. Thus it was concluded, that, addition of lidocaine to hyperbaric levobupivacaine shortens the duration of spinal block and hence this can be used to shorten the duration of stay at hospital for short procedures like TURP.

**Cappelleri et al**[20] studied intrathecal hyperbaric levobupivacaine and ropivacaine for outpatient knee surgery through a prospective randomised double blind study. 91 patients belonging to ASA 1 or 2 were randomly allocated to receive either 7.5mg of 0.5% hyperbaric

ropivacaine or 5mg or 7.5mg of 0.5% hyperbaric levobupivacaine intrathecally for unilateral spinal block. Lateral decubitus position was maintained for 15 minutes after spinal injection at L3-4 interspace using 25G whitacre spinal needle. Unilateral sensory block was present in following order: ropivacaine 7.5mg- 73%, levobupivacaine 7.5mg- 50%, levobupivacaine 5mg- 61%. Unilateral motor block was present in the following order: ropivacaine 7.5mg- 94%, levobupivacaine 7.5mg- 93%, levobupivacaine 5mg- 83%. Spinal block resolution time was shorter in group ropivacaine 7.5mg than in group levobupivacaine 7.5mg. Time for home discharge was also shorter in group ropivacaine 7.5mg than group levobupivacaine 5mg and group levobupivacaine 7.5mg.

Thus it was concluded, that 0.5% hyperbaric ropivacaine 7.5mg and 0.5% hyperbaric levobupivacaine 5mg provided adequate spinal block for outpatient knee surgery with faster recovery for home discharge.

**Erdil et al**[21] conducted a study to compare the hemodynamic parameters and block characteristics of intrathecal 0.5% levobupivacaine and 0.5% bupivcaine, 1.5ml each combined with fentanyl 15microgram, in elderly patients undergoing transurethral resection of prostate(TURP).

Time to reach sensory blockade, maximum block height, motor block was noted in both groups. Mean arterial pressure was noted at every 10 minutes interval until 30 minutes after intrathecal injection. Sensory and motor onset time was short in bupivacaine group with longer duration of sensory and motor block. Maximum sensory block height was also higher in bupivacaine group. The incidence of hypotension, nausea was less in levobupivacaine group. Hence it was concluded, that better hemodynamic stability and less side effects, levobupivacaine is a better choice for spinal anaesthesia in elderly individuals.

**Ashton et al**[22] regarding the better safety profile of ropivacaine and levobupivacaine over bupivacaine, conducted a study to compare the efficacy of 0.5% hyperbaric bupivacaine, 0.5% isobaric levobupivacaine, 0.75% isobaric ropivacaine in patients undergoing lower abdominal surgeries. 60 consenting patients posted for lower abdominal surgeries were divided into 3 groups of 20 each. Group B received 3ml of 0.5% hyperbaric bupivacaine, group R received 3ml of 0.75% ropivacaine and group L received 3ml of 0.5% levobupivacaine. Sensory and motor block characteristics, hemodynamic parameters and any adverse effects like nausea, vomiting, hypotension, bradycardia, shivering were monitored in all three groups. Time taken to reach sensory level of T10 was faster in

bupivacaine and this is significantly short when compared to other groups. Time to reach bromage 1 was not different in either bupivacaine or levobupivacaine group, but was significantly longer in ropivacaine group. Time to reach bromage 3 was statistically different in all three groups, with the shortest bromage 3 onset seen in bupivacaine group. Sensory and motor block durations were shorter in bupivacaine group.

Hence hyperbaric bupivacaine is an ideal choice of local anaesthetic with rapid onset and short duration of sensory block at the cost of hemodynamic stability for short duration surgeries.

**Lee et al**[23]designed a study to evaluate the effect of adding fentanyl to 0.5% levobupivacaine for patients undergoing urological surgery under spinal anaesthesia. 50 patients were randomly divided into two group of 25 each. 25 patients were given 2.6ml of 0.5% levobupivacaine intrathecally and the remaining 25 patients were given 2.3 ml of 0.5% levobupivacaine combined with 15 microgram(0.3ml) of fentanyl intrathecally at L3-L4 interspace.

Hemodynamic changes, quality of sensory and motor block were comparable in both groups. Side effects were negligible and insignificant between the two groups.

**Hazel bardsley** [24] et al compared the cardiovascular effects of levobupivacaine with that of racemic bupivacaine by IV administration of the drug to 14 healthy male volunteers. A randomised double blind complete cross over procedure was carried out by infusing the two drugs at 10mg per minute with 1 week wash out period. Once CNS symptoms appear or 150mg drug has been given, administration of the drug was discontinued.

Heart rate, arterial blood pressure, stroke index, cardiac index, ECG, acceleration index, ejection fraction were monitored. Mean dose of 56.1mg of levobupivacaine and mean dose of 47.9 mg of racemic bupivacaine were administered with maximum mean peak plasma concentration of 2.62 and 2.25 microgram per millilitre respectively. A statistically significant reduction in acceleration index, mean stroke index, ejection fraction was noted in levobupivacaine group. Thus levobupivacaine produces less effect on cardiovascular system.

**Indumathi et al** [25] compared hemodynamic stability and block characters after adding fentanyl 20µg, magnesium 50mg to two groups, namely, 2.5ml of 0.75% isobaric levobupivacaine and 2.5ml of 0.75% ropivacaine in 60 patients, of 30 each undergoing lower abdominal surgeries.

Time to reach T10 dermatome, onset of motor block, duration of sensory and motor block were assessed. It was concluded that, sensory, motor onset and its recovery were rapid in levobupivacaine group.

**Suman Chattopadhyay** compared two different concentrations of isobaric levobupivacaine in 44 patients undergoing vaginal hysterectomy under spinal anaesthesia. Each group of 22 patients each were assigned to receive either 2ml of 0.5% levobupivacaine or 4ml of 0.25% levobupivacaine combined with 25µg fentanyl.

Sensory block characters were comparable in both groups. Onset of motor block was rapid in 0.5% levobupivacaine group, which also required more amount of phenylephrine. Duration of sensory and motor block was shorter in 0.25% levobupivacaine group.

**Marcel P vercauteren et al** compared 0.125% levobupivacaine and 0.125% bupivacaine combined with 0.75µg/ml sufentanil and 1.25µg/ml epinephrine for combined spinal epidural technique for labor analgesia in 80 term parturients of 40 each. For intrathecal injection 2ml of this prepared solution is used and the rest epidurally.

The difference between the two groups lies only in motor block with comparable results in other parameters. No motor block seen in levobupivacaine group while grade 1 bromage motor block seen in bupivacaine group.

**Erkan yavuz et al** compared 1ml of 0.5% levobupivacaine and 1ml of 0.5% bupivacaine combined with 25µg fentanyl in 49 patients undergoing TURP. Both the groups were comparable in terms of hemodynamics and block characteristics. Complete motor block of bromage 3 was noted in bupivacaine group only at the beginning of surgery while no motor block present in levobupivacaine group. Towards the end of surgery, both the groups were comparable in motor block characteristics.

**Dhumal et al** compared intrathecal administration of 1.5ml of 0.5% bupivacaine (group B) and 1 ml of 0.5% bupivacaine with 25 µg fentanyl in 60 patients of 30 each who were subjected to caesarean section under spinal anaesthesia. Rapid onset of sensory blockade, prolonged duration of effective analgesia, rapid reversal of motor blockade was observed in group BF. The mean pulse rate was higher , with low mean arterial pressure and higher incidence of side effects in group B.

# MATERIALS AND METHODS

# MATERIAL AND METHODS

This prospectively designed randomised controlled study was done after getting approval from Ethical committee of Mahatma Gandhi Memorial Government hospital, trichy. Period of study was from August 2012 to April 2014. 80 patients were randomly divided into two groups of 40 each.

**Inclusion criteria:**

- Age : 18 to 35 years
- ASA physical status 1 or 2
- Singleton pregnancy
- Elective caesarean section done under spinal anaesthesia
- Term gestational age

**Exclusion criteria:**

- Body weight more than 80kg
- Height <150cm
- Patient´s refusal
- History of allergy to drugs
- Maternal factors like coagulopathy, spinal disorders, uterine anomaly.
- IUGR(intrauterine growth retaradation), intrauterine anomaly, PROM.

Randomly patients were assigned into two groups, by computer generated random allocation numbers.

- Group L (n=40) received injection levobupivacaine. 0.5% Levobupivacaine was combined with 0.3 ml of normal saline, with the total volume of injectate was 2.3ml.
- Group LF (n=40) received levobupivacaine with fentanyl. 0.5% Levobupivacaine was combined with 0.3ml (15microgram) of fentanyl, with the total volume of injectate was 2.3ml.

**Table 1**

**CHARACTERISTICS OF ANAESTHETIC SOLUTION**

| Groups | volume | Specific gravity | Drugs |
|---|---|---|---|
| Group L | 2.3ml | 1.015 | Levobupivacaine 10mg + 0.3ml NS |
| Group LF | 2.3ml | 1.015 | Levobupivacaine 10mg + 0.3ml fentanyl |

Specific gravity of both the group drugs was 1.015. Though the solution may appear hyperbaric in vitro, when injected into CSF, it mixes with CSF in vivo and behaves as isobaric solution. The study drug solution was prepared by my assistant professor who was not involved in the study. Both anaesthetist and patients were blinded to the study drug.

All patients subjected to the study fasted overnight, received oral ranitidine 150mg and metoclopramide 10mg night before surgery. In the preoperative room, intravenous access confirmed or secured. Preloading was done with 15ml/kg of lactated ringer´s solution for 15minutes. Injection ranitidine 50mg and injection metoclopramide 10mg were given slow IV 30minutes before spinal technique. After arrival in the

operating room, monitors like ECG, NIBP, SpO2 were attached.Baseline pulse rate, blood pressure, SpO2 of the patient noted.

Under sterile aseptic precaution, in the right lateral position, using either 25G or 23G Quincke´s needle, by midline approach spinal anaesthesia was performed at L3-L4 IVS. After completion of spinal injection, patient was turned to supine posture, a wedge was placed underneath the right buttock, and oxygen administered through facemask at 4-6L/mt.

Zero time was the time of induction of spinal anaesthesia. Sensory block was assessed by pinprick using a small needle at mid axillary line every minute until it reached its maximum level. When the sensory block reached T6, surgery was allowed to proceed. Onset of sensory block was considered when the level of blockade reached T8. Motor block was assessed by modified bromage scale. Onset of motor block was considered when bromage grade 3 was reached. Maximum sensory block height reached, two segment regression time, time taken to regress to T12 dermatome, time taken for complete motor recovery (bromage scale-0) were recorded.

**Table 2:Modified Bromage scale.**

| | |
|---|---|
| Bromage scale-0 | no paralysis,able to flex hip/knees/ankle |
| Bromage scale- 1 | able to move knees,unable to raise extended legs |
| Bromage scale- 2 | able to flex ankles,unable to flex knees |
| Bromage scale- 3 | unable to move any part of lower limb |

Maternal pulse rate and blood pressure were recorded every 1 minute until baby delivery, every 5 minutes until the end of surgery, every 15minutes until the period of observation for sensory and motor block endpoints.

In our study, hypotension was defined as decrease in systolic blood pressure to less than 90mmHg or 30% fall from baseline value and treated with IV Ephedrine 6mg bolus. Maternal bradycardia was defined as pulse rate below 60/ minute, treated with inj.Atropine 0.3-0.6mg IV. Complications like nausea and vomiting, pruritus, respiratory depression were noted in both intraoperative and postoperative period. Respiratory depression was defined as respiratory rate of less than 10/minute. Both mother and neonate were observed for 24 hours for the complications mentioned above.

Sedation score was assessed every 15 minutes intraoperatively and every 30 minutes postoperatively until fully awake.

**Table 3**

**Modified Ramsay sedation scale**

| Score | Description |
|---|---|
| 1 | Anxious and agitated or restless, or both |
| 2 | Cooperative, oriented and tranquil |
| 3 | Drowsy, but responds to commands |
| 4 | Asleep, brisk response to light glabellar tap or loud auditory stimulus |
| 5 | Asleep, sluggish response to light glabellar tap or loud auditory stimulus |
| 6 | Asleep and unarousable |

**Visual analogue score:**

Postoperative pain was assessed by visual analogue score using word scale. The rescue analgesia used was injection Tramadol 100mg IM.

**Table 4**

**Visual analogue score**

| | |
|---|---|
| Score 0 | No pain |
| Score 1-2 | Least pain |
| Score 3-4 | Mild pain |
| Score 5-6 | Moderate pain |
| Score 7-8 | Severe pain |
| Score 9-10 | Excruciating pain |

Neonatal assessment was done using Apgar scoring at 1st and 5th minute of delivery.

**Table 5**

**APGAR score**

| Apgar sign | 0 | 1 | 2 |
|---|---|---|---|
| Appearance(skin colour) | Cyanosis over entire body | Pink colour over body, hands and feet are bluish | Normal colour over the entire body (pink) |
| Heart rate(pulse) | Absent-no heart beat | <100 beats /min | >100 beats/min |
| Grimace(reflex irritability) | Absent –no response to stimulation | Only facial movements at stimulation | Pulls away, sneezes, coughs at stimulation |
| Activity (muscle tone) | Absent movements. Floppy tone. | Arms and leg flexed with little movements. Low tone. | Active flexor tone, spontaneous movements. |
| Respiration (rate and effort) | Absent-no breathing effort. | Slow, irregular breathing, weak cry. | Regular breathing, strong cry. |

Normal Apgar score at 1st and 5th minute is more than or equal to 8/10.

## STATISTICAL ANALYSIS

The observed data's were analyzed by SPSS version 21.0 software. The collected data were tabulated and expressed as mean, standard deviation, numbers and percentages.

Continuous variables were compared with one way ANOVA. The comparison was done using chi-Square or Benforroni test as appropriate value reported at the 95% confidence interval. P value <0.05 was considered as statistically significant.

# OBSERVATIONS AND RESULTS

**Table 6**

**Demographic distribution**

**T-Test**

| Demographic data | Mean | S.D | Statistical inference |
|---|---|---|---|
| **Age (years)** | | | |
| Group L (n=40) | 24.95 | 2.124 | T=.000 Df=78<br>1.000>0.05<br>Not Significant |
| Group LF (n=40) | 24.95 | 2.025 | |
| **Wt(kg)** | | | |
| Group L (n=40) | 64.18 | 5.638 | T=-.826 Df=78<br>.411>0.05<br>Not Significant |
| Group LF (n=40) | 65.08 | 3.964 | |
| **Ht(cm)** | | | |
| Group L (n=40) | 155.88 | 2.662 | T=-.212 Df=78<br>.832>0.05<br>Not Significant |
| Group LF (n=40) | 156.00 | 2.602 | |

Demographic variables like age, weight and height are comparable in both groups.

## CHART -1

## DEMOGRAPHIC DISTRIBUTION

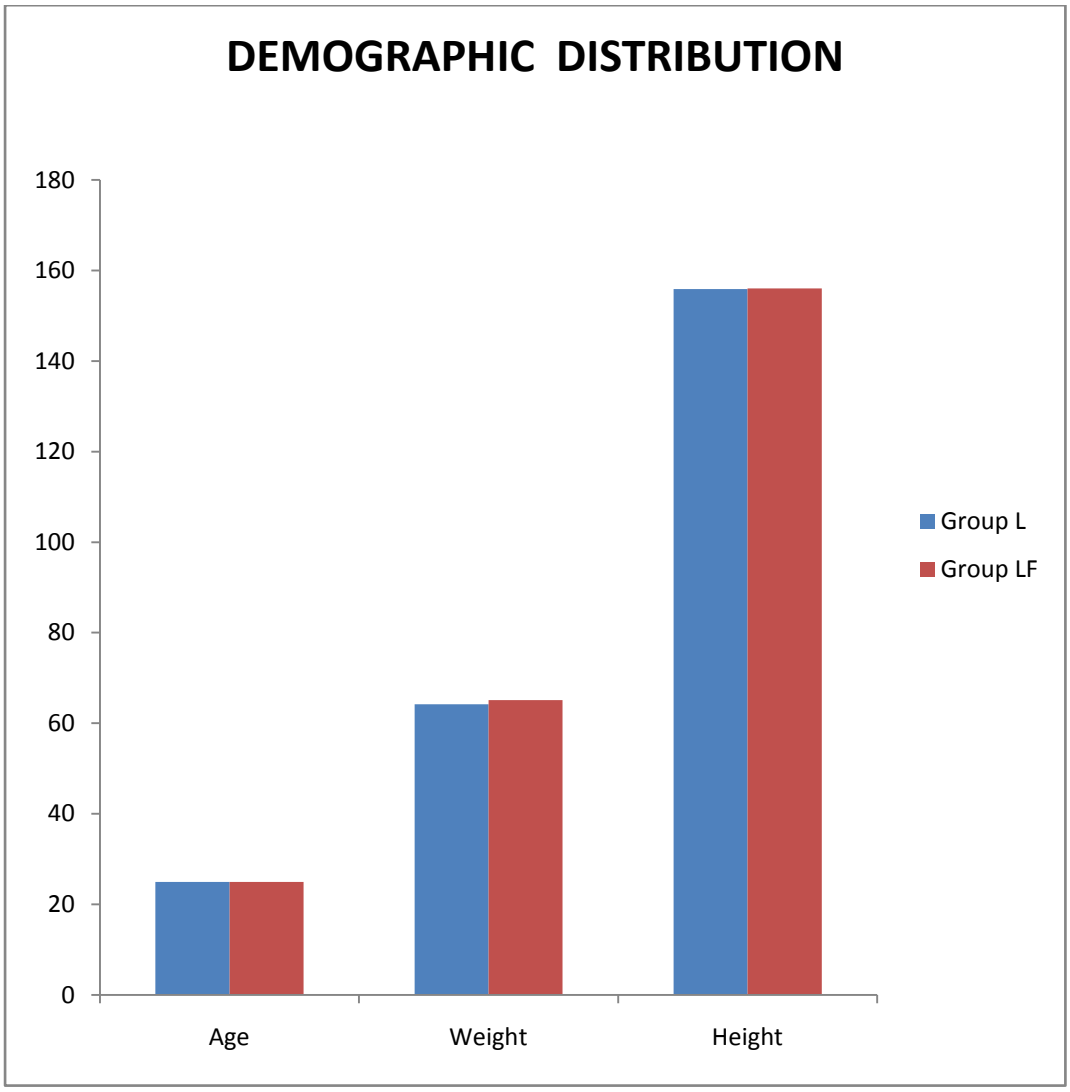


**Table 7**

**ASA Distribution**

**SAM**

| Group | ASA-1 (n=44) | ASA-2 (n=36) | Total (n=80) | Statistical inference |
|---|---|---|---|---|
| L | 23(52.3%) | 17(47.2%) | 40(50%) | X2=.202 Df=1 .653>0.05 Not Significant |
| LF | 21(47.7%) | 19(52.8%) | 40(50%) | |

In both the groups L and LF,ASA 1 and 2 are equally distributed and there is no statistical difference.

**Table 8**

**MEAN PULSE RATE**

| **Pre-op (Pulse)** | | | |
|---|---|---|---|
| *Levobupivacaine (n=40)* | 91.65 | 3.867 | T= -.439 Df=78<br>.232 <0.05<br>Not Significant |
| *Levobupivacaine + Fentanyl (n=40)* | 89.38 | 3.979 | |

**T-Test**

| **Group Statistics** | **Mean** | **S.D** | **Statistical Inference** |
|---|---|---|---|
| **Intraop pulse (bpm)** | | | |
| *L (n=40)* | 82.1630 | 2.51036 | T=1.932 Df=78<br>.102>0.05<br>Not Significant |
| *LF (n=40)* | 84.0441 | 4.23833 | |
| **Postop pulse (bpm)** | | | |
| *L (n=40)* | 78.7125 | 2.13003 | T=1.453 Df=78<br>.157>0.05<br>Not Significant |
| *LF (n=40)* | 80.6375 | 3.60802 | |

bpm- beats per minute

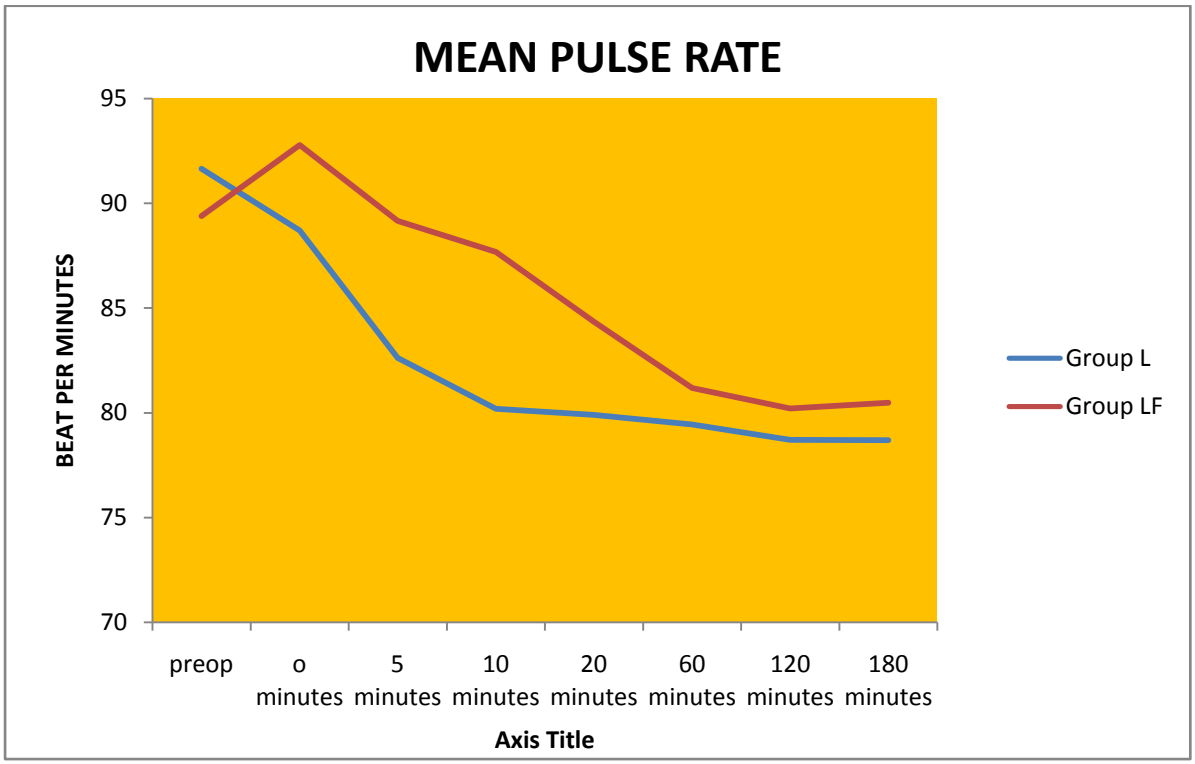
**Hemodynamic changes**

Preoperative vital signs were considered as baseline values. Intraoperative hemodynamics were estimated from the time of administration of spinal anaesthesia to the end of surgery and shifting of patient to recovery. Post operative vital signs were recorded until the sensory and motor end points of the study.

Both intraoperative and post operative pulse rate in the both L and LF group are comparable and statistically not significant.

## CHART -2

## MEAN PULSE RATE




The preoperative pulse rate between the two groups shows no statistical difference . Soon after induction of spinal anaesthesia, the falling trend in pulse rate follows proportionately in both groups. The initial rise in pulse rate seen in group LF coincides with fall in blood pressure. Hence the intraoperative and postoperative pulse rate between group L and group LF are not statistically significant.

**Table 9**

**Mean arterial blood pressure**

| **Pre-op (MAP)** | **mean** | **SD** | |
|---|---|---|---|
| *Group L (n=40)* | 89.37 | 8.250 | T= -.415 Df=78<br>.182 <0.05<br>Not Significant |
| *Group LF (n=40)* | 93.95 | 5.331 | |

| **Intraop BP (MAP) (mm Hg)** | Mean | SD | |
|---|---|---|---|
| *Group L (n=40)* | 84.4020 | 4.68130 | T=1.410 Df=78<br>.162>0.05<br>Not Significant |
| *Group LF (n=40)* | 82.7181 | 5.92426 | |
| **Postop BP (MAP) (mm Hg)** | | | |
| *Group L (n=40)* | 88.2766 | 4.94805 | T=.938 Df=78<br>.351>0.05<br>Not Significant |
| *Group LF (n=40)* | 87.3006 | 4.33748 | |

Baseline mean arterial pressures were comparable between group L and group LF. Even though the intraoperative mean arterial pressure is not statistically significant between the two groups, the incidence of hypotension is high in group LF. In the postoperative period, the mean arterial pressure between groups L and LF are comparable.

## Chart 3

## MEAN ARTERIAL PRESSURE

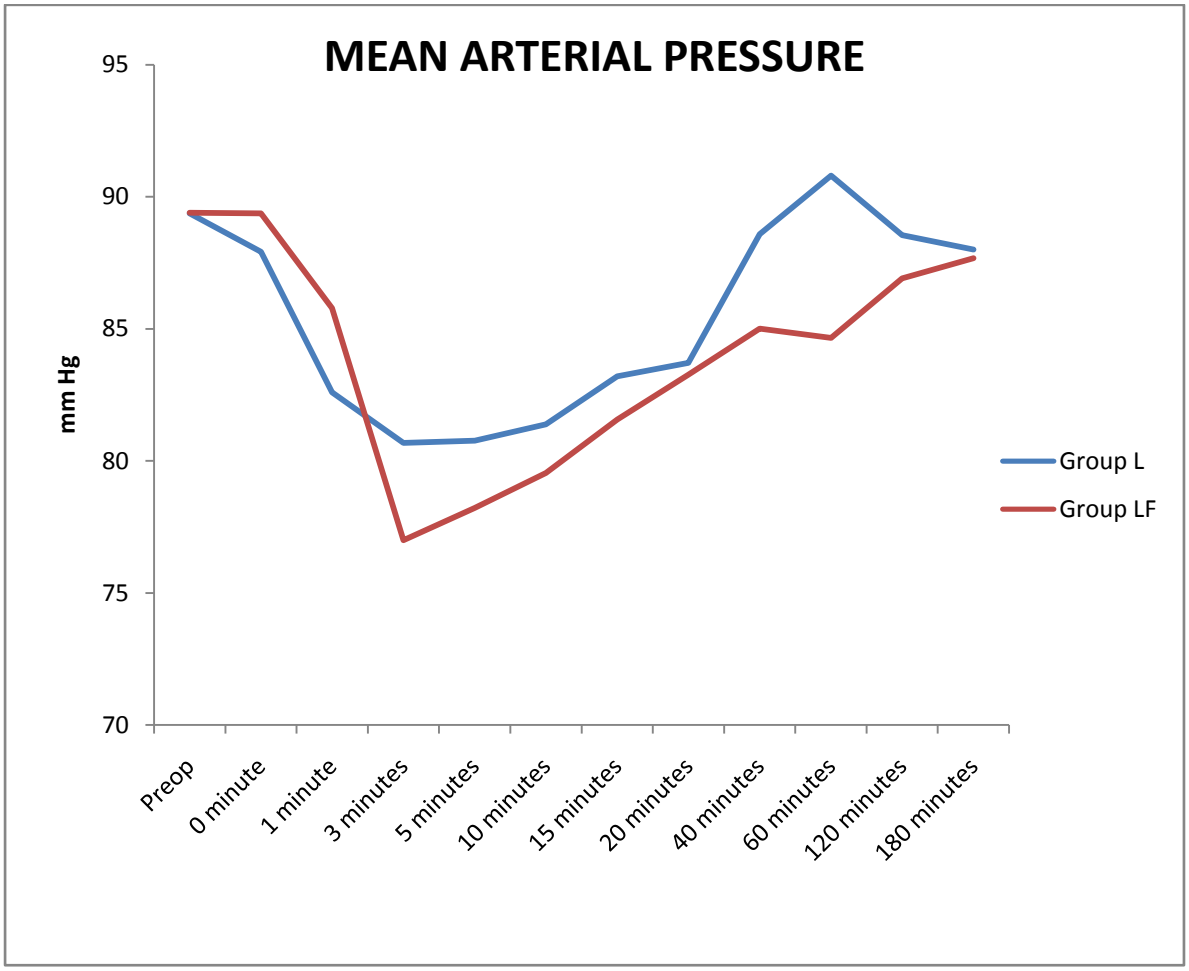


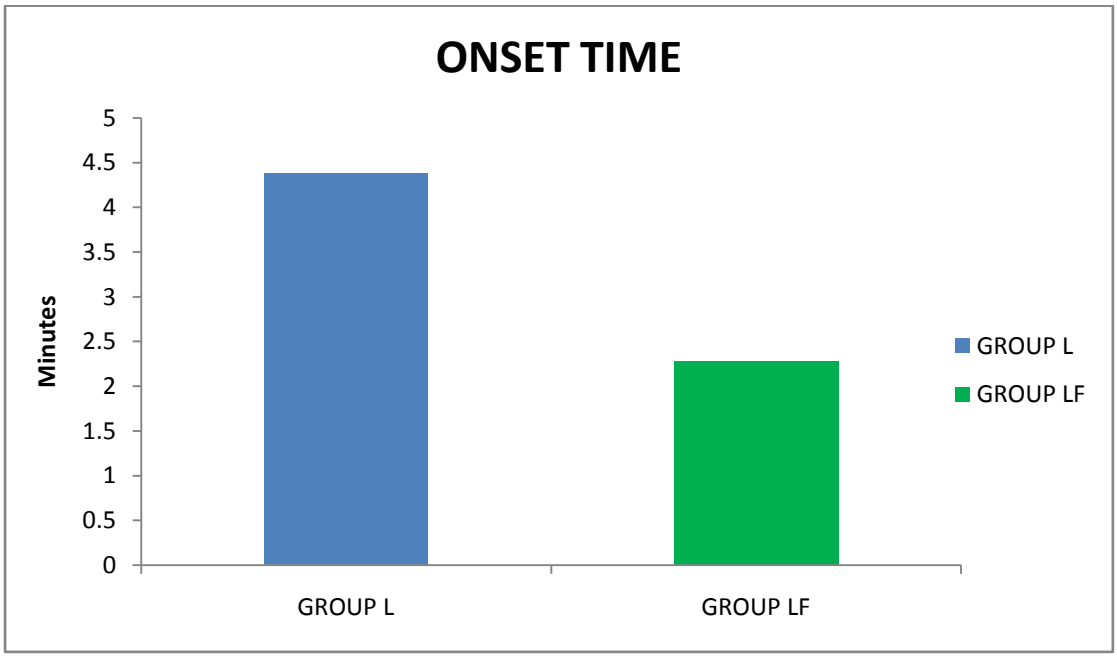
**Table 10**

**Characteristics of spinal block:**

| Sensory(Onset time)( in minutes) | mean | SD | |
|---|---|---|---|
| Group L (n=40) | 4.38 | .490 | T=19.913 Df=78 .000<0.05 Significant |
| Group LF (n=40) | 2.28 | .452 | |
| Sensory(2 segment regression) (in minutes) | | | |
| Group L (n=40) | 78.55 | 13.399 | T=-7.228 Df=78 .000<0.05 Significant |
| Group LF (n=40) | 95.60 | 6.559 | |
| Sensory(regression to T12) (in minutes) | | | |
| Group L (n=40) | 129.23 | 11.617 | T=-18.647 Df=78 .000<0.05 Significant |
| Group LF (n=40) | 176.50 | 11.052 | |

## CHART 4

## TIME OF ONSET OF SENSORY BLOCK




We observed a shorter onset time for sensory blockade in group LF, as can be elucidated from the above figure.

**Table 11**

**Time of onset of sensory block**

| Sensory(Onset time) ( in minutes) | Mean | SD | |
|---|---|---|---|
| Group L (n=40) | 4.38 | .490 | T=19.913 Df=78 .000<0.05 Significant |
| Group LF (n=40) | 2.28 | .452 | |

Onset time for sensory block was noted in minutes. The mean onset time in group L is 4.38±.490 minutes whereas it is rapid in group LF with a mean onset time of 2.28±.452 minutes. This difference between the two groups is statistically significant with a p value of .000.

**Table 12**

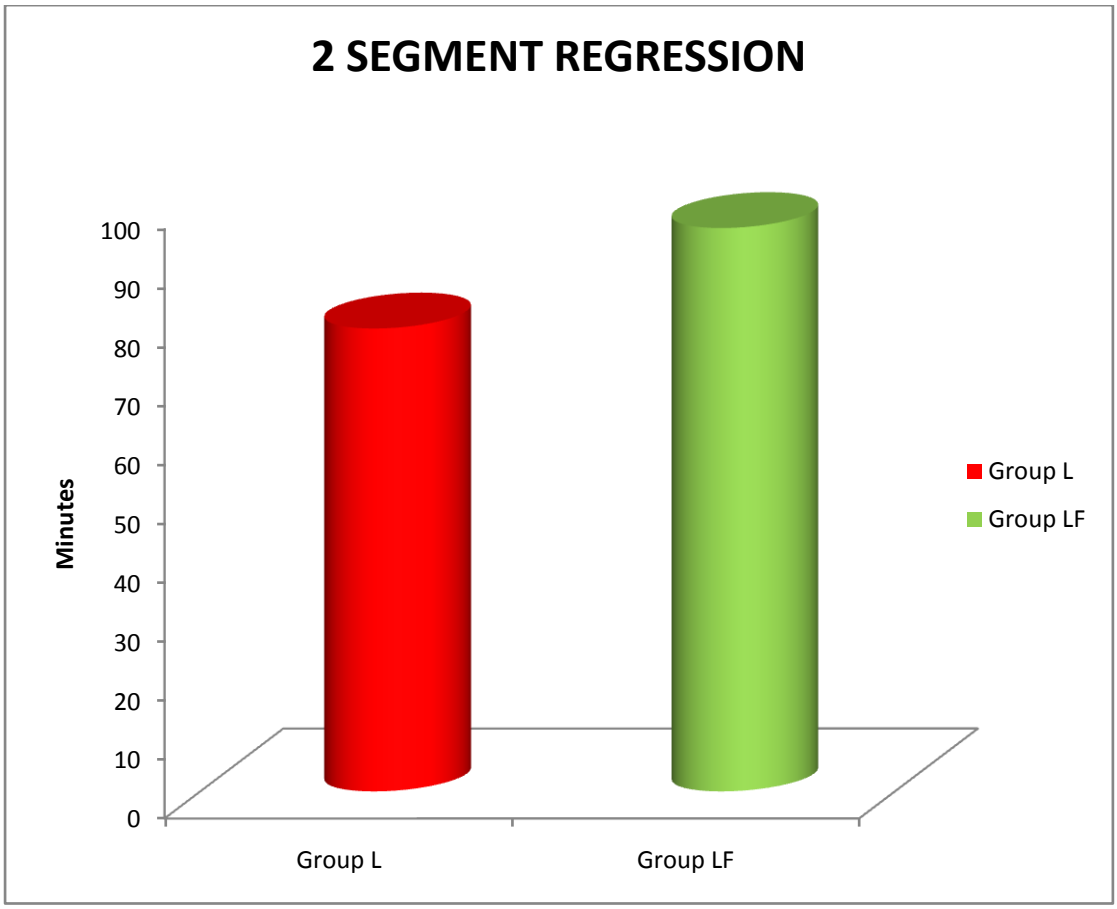
**Time for two segment regression**

| Sensory(2 segment regression) (in minutes) | Mean | SD | P value |
|---|---|---|---|
| Group L (n=40) | 78.55 | 13.399 | T=-7.228 Df=78 .000<0.05 Significant |
| Group LF (n=40) | 95.60 | 6.559 | |

The time taken for two segment regression of sensory blockade is 78.55±13.399 minutes in group L and it is 95.60±6.559 minutes in group LF. This time duration is longer in group LF. There is statistically significant difference between the two groups with a p value of .000.

## CHART 5

## TIME TAKEN FOR TWO SEGMENT REGRESSION OF SENSORY BLOCK




From the figure it is evident that the time for 2 segment regression is longer in group LF.

**Table 13**

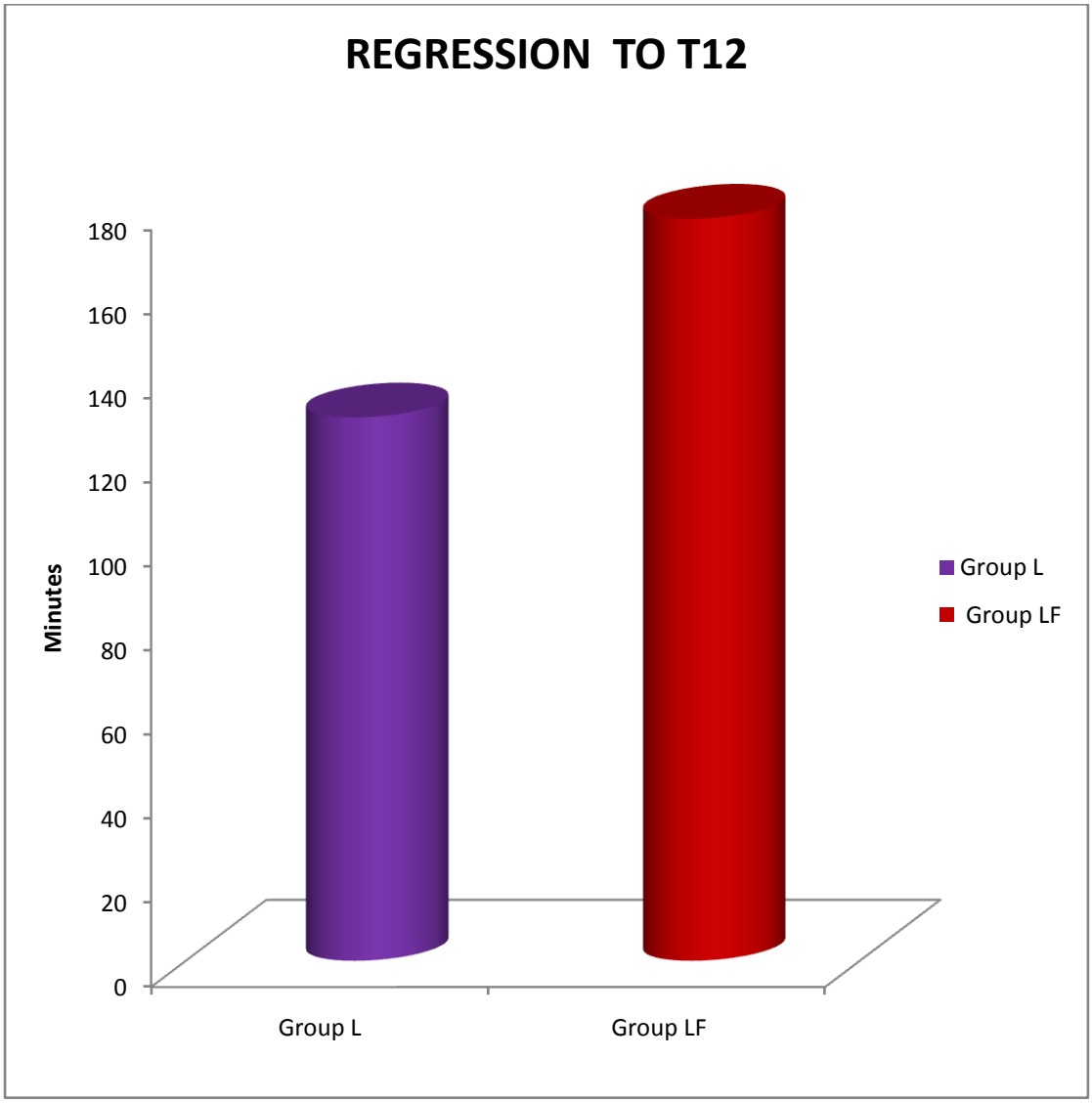
**Time taken for sensory regression to T12 dermatome**

| Sensory regression to T12 (in minutes) | Mean | SD | P value |
|---|---|---|---|
| Group L (n=40) | 129.23 | 11.617 | T=-18.647<br>Df=78<br>.000<0.05<br>Significant |
| Group LF (n=40) | 176.50 | 11.052 | |

The mean duration for sensory regression to T12 is 129.23±11.617 minutes in group L and it is 176.50±11.052 minutes in group LF. From statistical point of view, it is significant, with a p value of .000.

## CHART 6

## TIME FOR SENSORY REGRESSION TO T12




2 dermatomal segment regression time is longer in group LF as is seen in the above figure.

**Table 14**

**Duration of effective analgesia**

| **Time for Rescue Analgesia ( in minutes)** | Mean | SD | P value |
|---|---|---|---|
| Group L (n=40) | 132.70 | 8.058 | T=-28.047 Df=78 .000<0.05 Significant |
| Group LF (n=40) | 179.90 | 6.953 | |

Effective analgesia is defined as the time period between induction of spinal anaesthesia and the first request for analgesia. This effective analgesia period is longer in group LF with a mean value of 179.90±6.953 minutes, whereas it is only 132.70±8.058 minutes and this is statistically significant, with a p value of .000.

## CHART 7

## EFFECTIVE ANALGESIA PERIOD

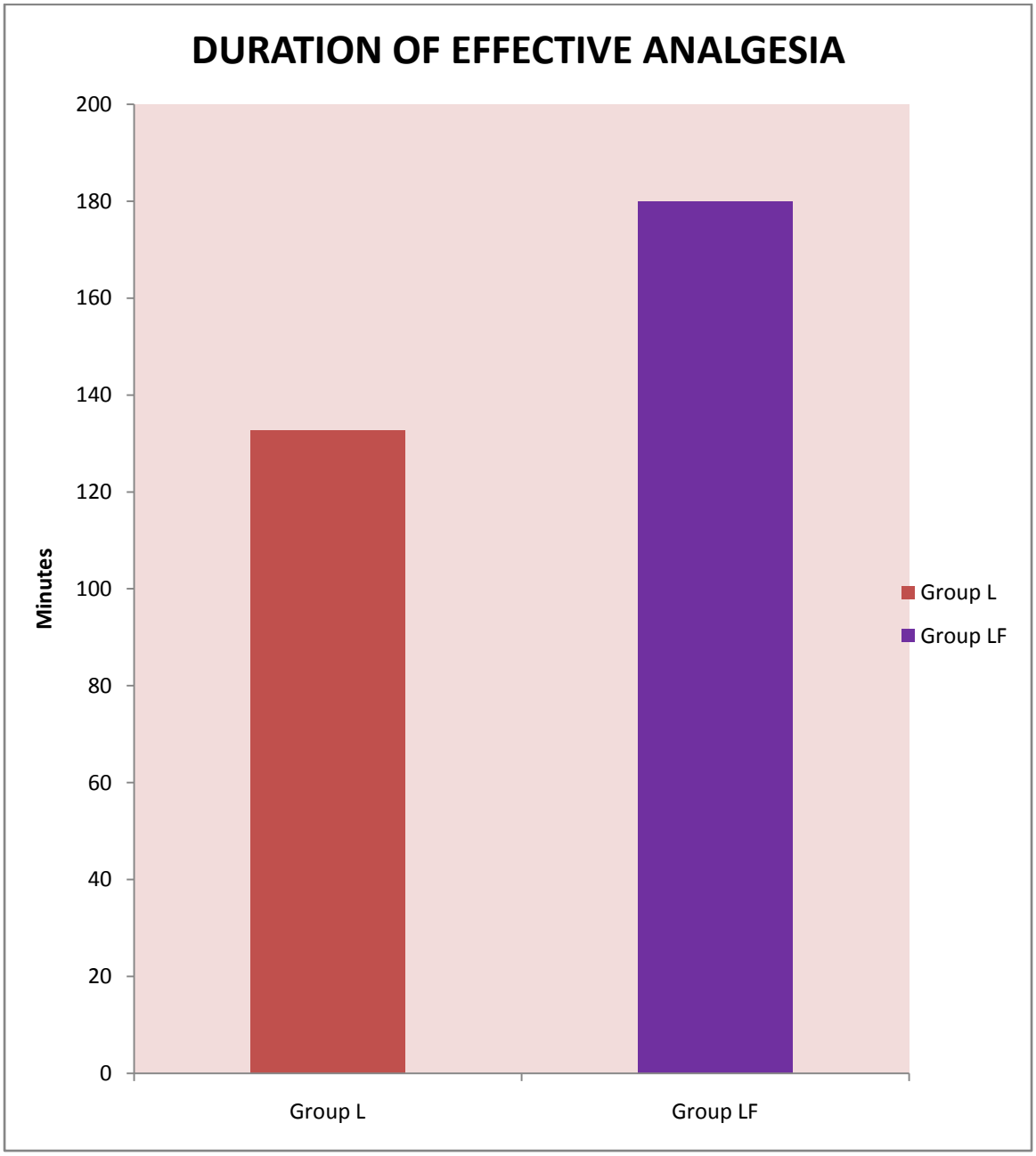


**Table 15**

**Maximum height of sensory blockade**

| | L (n=40) | | LF (n=40) | | Total (n=80) | | Statistical inference |
|---|---|---|---|---|---|---|---|
| | **n** | **%** | **n** | **%** | **n** | **%** | |
| **Sensory(max block)** | | | | | | | |
| T4 | 7 | 17.5% | 39 | 97.5% | 46 | 57.5% | $X^2$=56.261 df=2 .000<0.05 Significant |
| T5 | 0 | .0% | 1 | 2.5% | 1 | 1.3% | |
| T6 | 33 | 82.5% | 0 | .0% | 33 | 41.3% | |

In group L, majority of patients developed maximum sensory block height of T6, while in group LF majority of patients developed maximum sensory block height of T4 which is statistically significant.

**Table 16**

**Motor onset time**

| **Motor Onset (minutes)** | **Mean** | **SD** | |
|---|---|---|---|
| Group L (n=40) | 5.75 | .840 | T=20.106 Df=78<br>.000<0.05<br>Significant |
| Group LF (n=40) | 2.70 | .464 | |

In group L the mean onset time for motor block of grade 3 Bromage was 5.75±0.840 minutes while group LF it was 2.70±o.464. Both the groups shows statistical significance with P value of 0.000<0.05.

## CHART 8

## MOTOR ONSET TIME

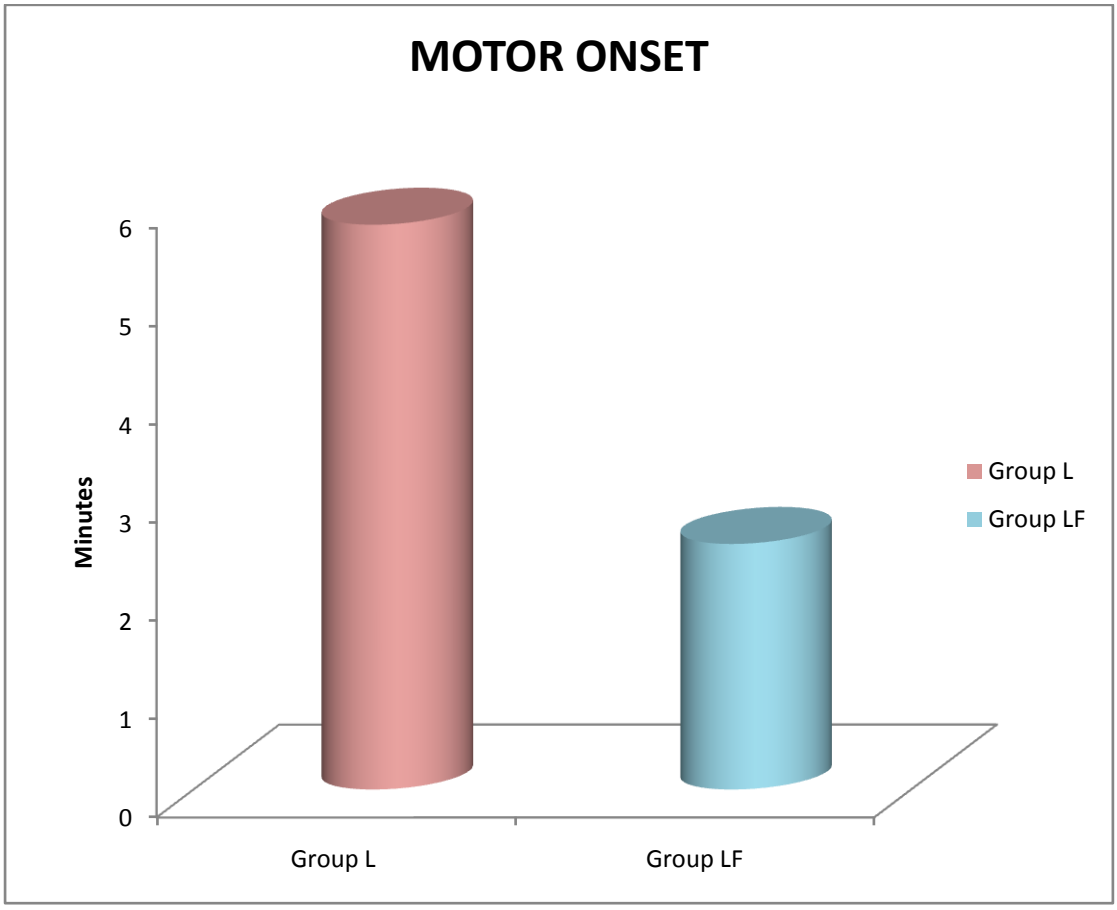


**Table 17**

**Motor recovery time**

| **Motor Recovery (minutes)** | **Mean** | **SD** | |
|---|---|---|---|
| Group L (n=40) | 152.75 | 9.407 | T=22.052 Df=78<br>.000<0.05<br>Significant |
| Group LF (n=40) | 116.33 | 4.543 | |

Complete reversal of motor blockade (from the onset of bromage grade 3 to grade 0) occurred in 152.75 minutes in group L while it took 116.33 minutes in group LF which is statistically significant with a p value of .000.

## CHART 9

## MOTOR RECOVERY TIME

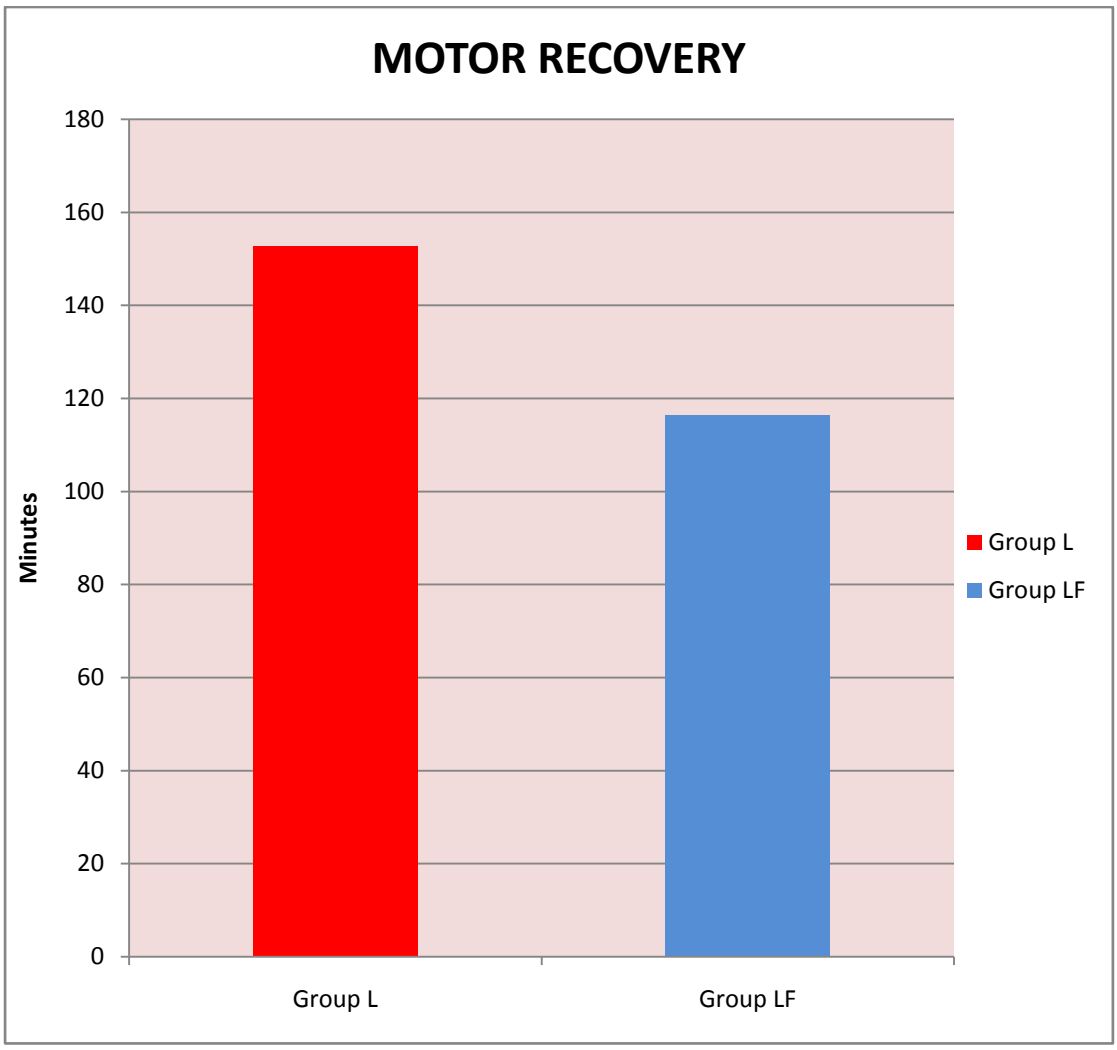


**Table 18**

**Modified Ramsay sedation score**

| **RSS** | Group L | Group LF |
|---|---|---|
| Intraoperative | 2 | 2 |
| Postoperative | 2 | 2 |

Through out intraoperative and post operative period , both the groups L and LF patients showed a similar Ramsay sedation score of 2, which is comparable.

**Table 19**

**DURATION OF SURGERY**

| **DURATION OF SURGERY (minutes)** | **mean** | **SD** | |
|---|---|---|---|
| Group L (n=40) | 35.53 | 2.837 | T=-.546 Df=78<br>.587>0.05<br>Not Significant |
| Group LF (n=40) | 35.85 | 2.476 | |

In both the groups L and LF , the mean duration of surgery was 35 minutes which is comparable.

## CHART 10

## DURATION OF SURGERY

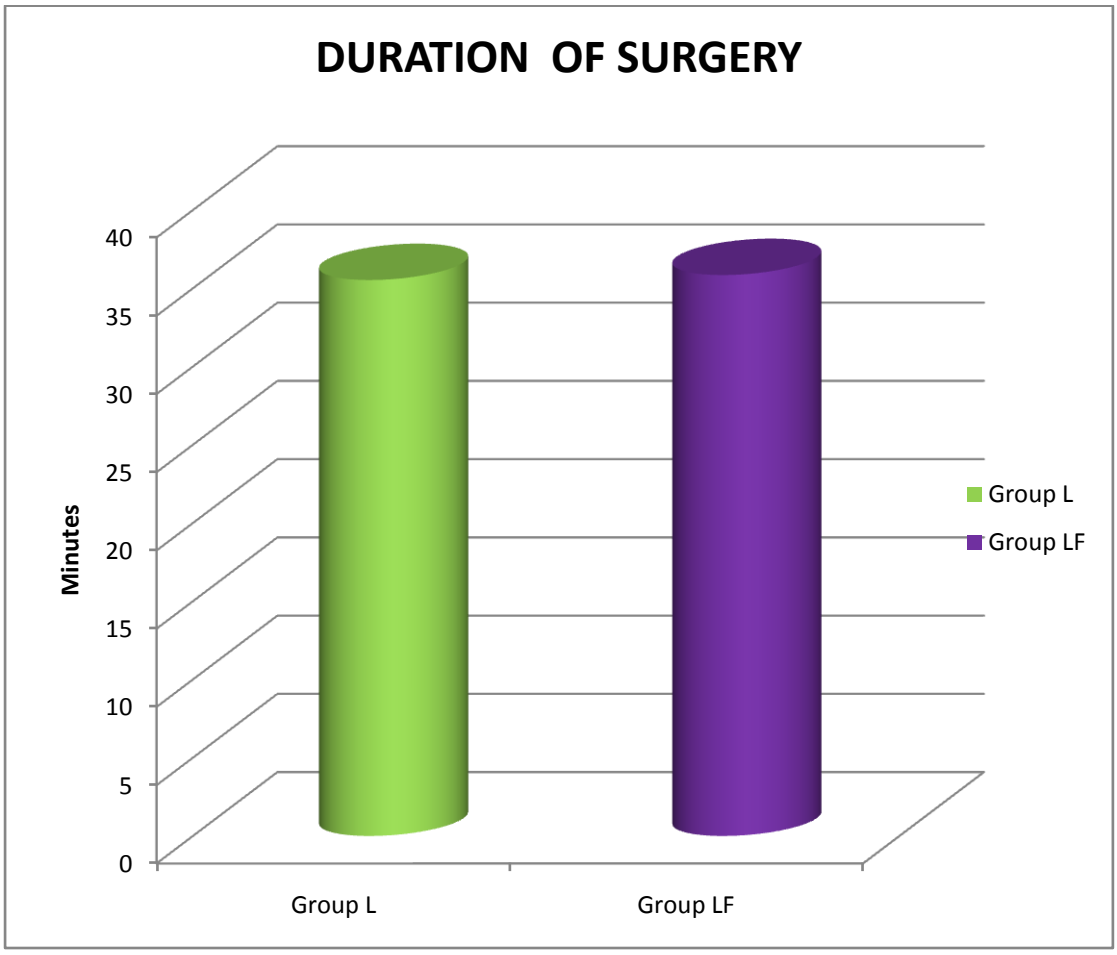


**Table 20**

**Ephedrine usage**

| **Ephedrine** | mean | SD | |
|---|---|---|---|
| Group L (n=40) | .10 | .304 | T=-4.556 Df=78 .000<0.05 Significant |
| Group LF (n=40) | .53 | .506 | |

The usage of the drug ephedrine was high in group LF which was statistically significant with P value of 0.000.

## CHART 11

## EPHEDRINE USAGE

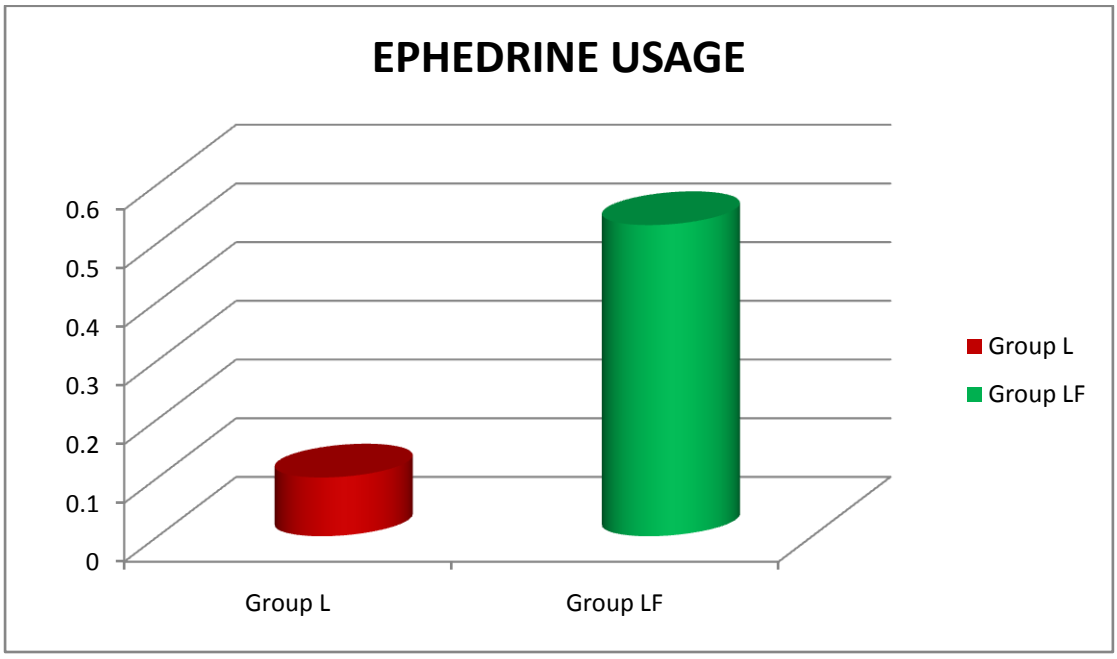


**Table 21**

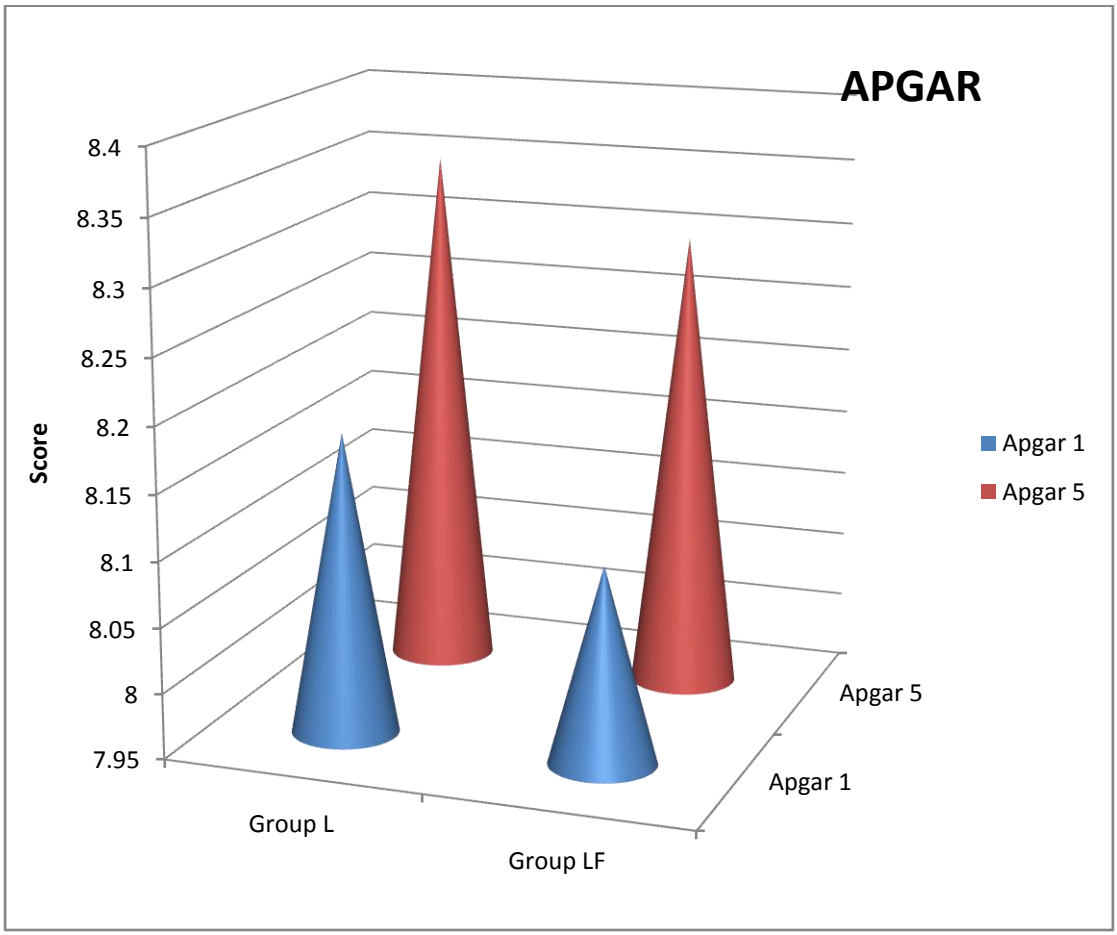
**APGAR at 1 MINUTE and 5 MINUTE**

| **APGAR (1mt)** | **mean** | **SD** | |
|---|---|---|---|
| Group L (n=40) | 8.18 | .385 | T=.967 Df=78<br>.336>0.05<br>Not Significant |
| Group LF (n=40) | 8.10 | .304 | |
| **APGAR (5mt)** | | | |
| Group L (n=40) | 8.35 | .483 | T=.472 Df=78<br>.638>0.05<br>Not Significant |
| Group LF (n=40) | 8.30 | .464 | |

Neonatal assessment in the form of Apgar scoring done in both group L and LF were comparable with the score of more than 8.

## CHART 12

## APGAR at 1MINUTE and 5 MINUTE



## ADVERSE EFFECTS

## TABLE 22

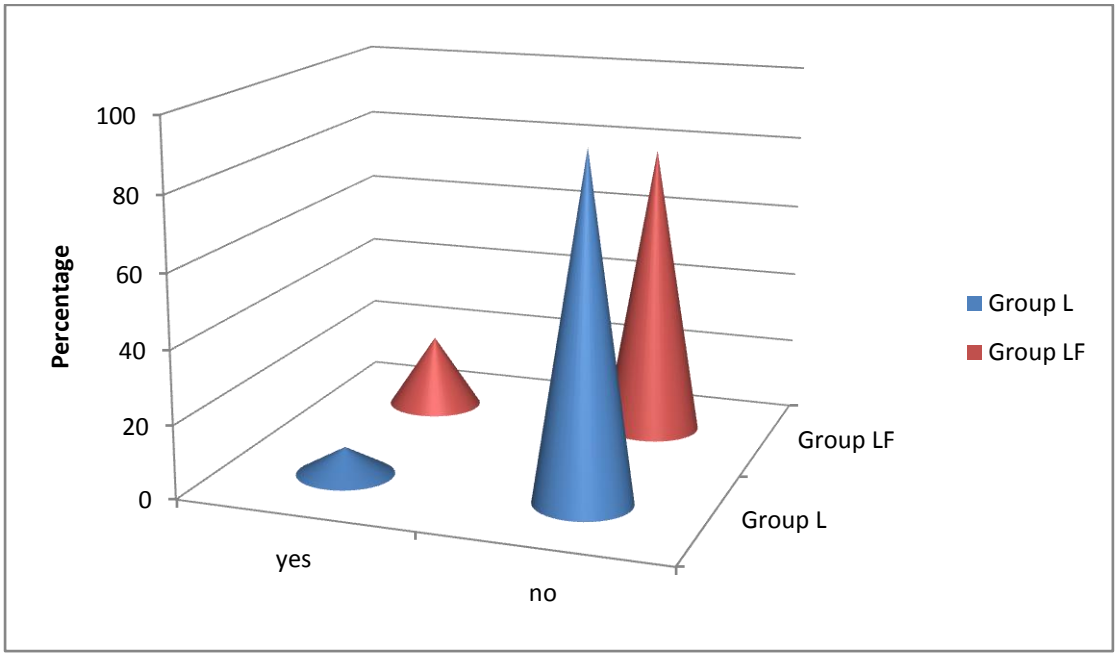
## INCIDENCE OF NAUSEA AND VOMITING

| **NOV** | Group L | | Group LF | | | | |
|---|---|---|---|---|---|---|---|
| Yes | 3 | 7.5% | 8 | 20.0% | 11 | 13.8% | $X^2$=2.635 df=1 .105>0.05 Not Significant |
| No | 37 | 92.5% | 32 | 80.0% | 69 | 86.3% | |

The incidence of nausea and vomiting was found to be higher in group LF with 20% having nausea and vomiting. Only 7.5% in group L had nausea and vomiting.

## CHART 13

## INCIDENCE OF NAUSEA AND VOMITING




The high incidence of nausea and vomiting noted among patients in group LF could be attributed to the high incidence of hypotension and the usage of fentanyl.

**Table 23**

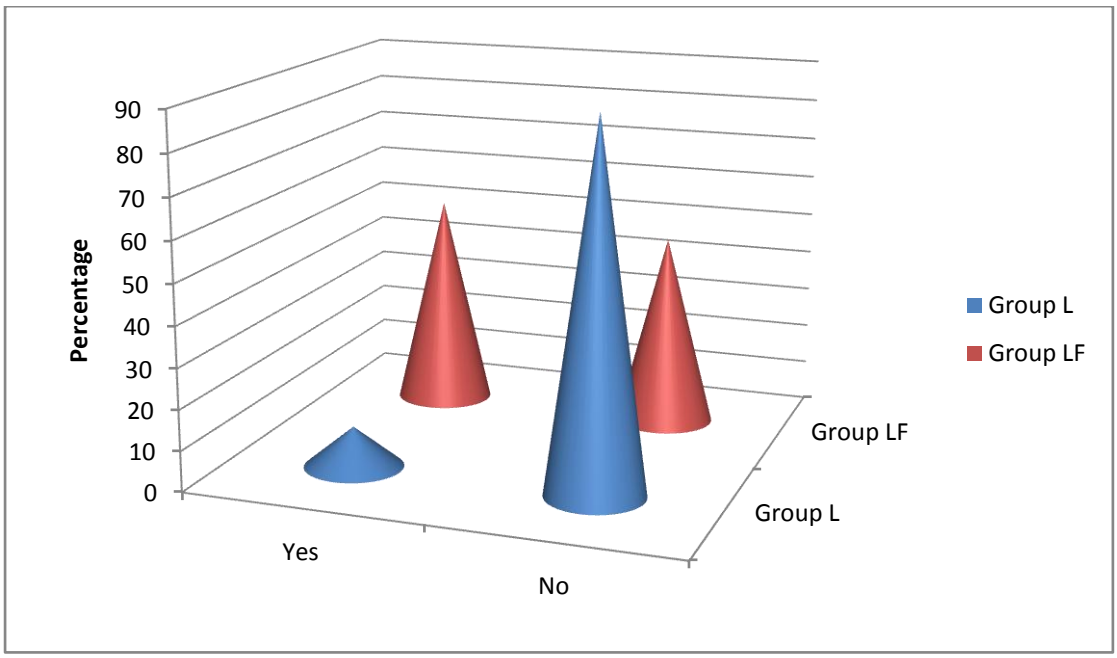
**Incidence of Hypotension**

| **Hypotension** | Group L | n=40 | Group LF | n=40 | Total | | |
|---|---|---|---|---|---|---|---|
| Yes | 4 | 10.0% | 21 | 52.5% | 25 | 31.3% | $X^2$=16.815 df=1 .000<0.05 Significant |
| No | 36 | 90.0% | 19 | 47.5% | 55 | 68.8% | |

Only 10% of patients in group L had episode of hypotension, while 52.5% patients in group LF had hypotension. A single episode of fall in BP was noted in few patients of group LF which was managed with vasopressor, ephedrine and crystalloids.

## CHART 14

## INCIDENCE OF HYPOTENSION




In the above figure, the high incidence of hypotension in group LF is depicted by the relative height of the cone in group LF.

**Table 24**

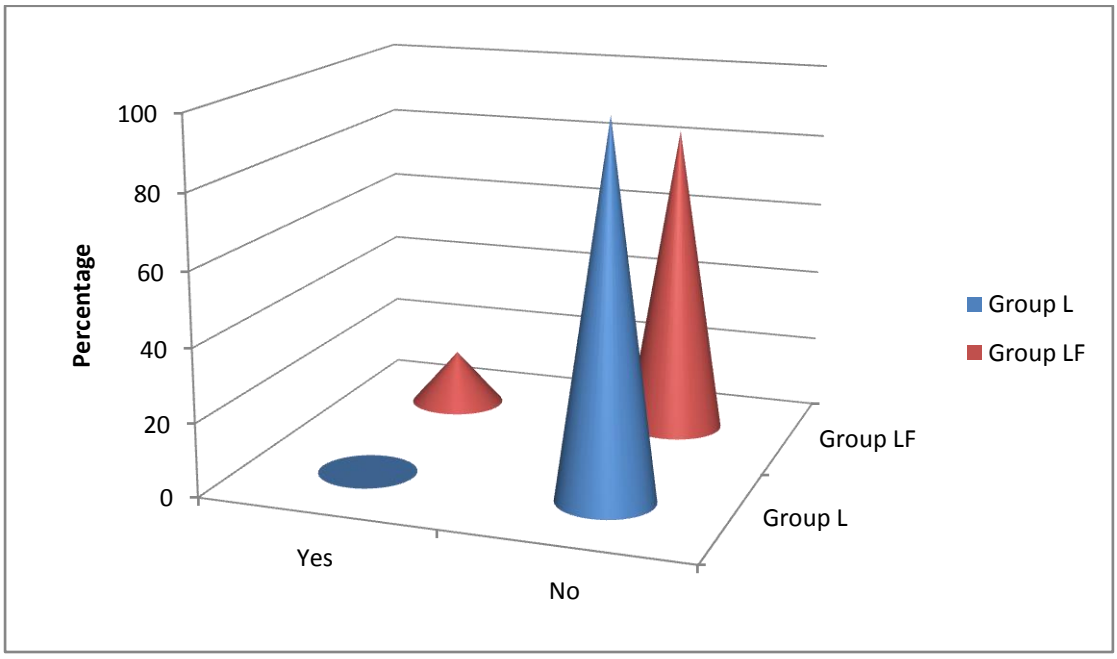
**Incidence of Pruritus**

| Pruritus | Group L | n=40 | Group LF | n=40 | Total | n=80 | |
|---|---|---|---|---|---|---|---|
| Yes | 0 | 0% | 6 | 15.0% | 6 | 7.5% | $X^2$=6.486 df=1 .011<0.02 Significant |
| No | 40 | 100.0% | 34 | 85.0% | 74 | 92.5% | |

Pruritus was noted among few patients in group LF. 15% of patients among group LF complained of pruritus while there was no incidence of pruritus among patients in group L.

## CHART 15

## INCIDENCE OF PRURITUS




Fentanyl, a synthetic opioid is known to produce side effects like pruritus. So adding fentanyl to levobupivacaine has caused pruritus in group LF which is clearly noted in the above figure.

# DISCUSSION

# DISCUSSION

Adequate pain relief following caesarean section enables early bonding of mother with the newborn and promotes early breast feeding. Pregnancy by itself is a state of hypercoagulability. This coupled with immobilisation due to pain in the postoperative period, predisposes the patient to the risk of developing deep vein thrombosis and pulmonary thromboembolism. If the postoperative analgesia is prolonged, emotional bonding, promotion of adequate breastfeeding, early ambulation is achieved.

There are many methods to achieve this. Parenteral drugs, nerve blocks like TAP block, wound infiltration, combined spinal epidural technique are some alternative methods. If this aim of postoperative analgesia is initiated from the intraoperative period, some of the morbidities like nausea, vomiting, early onset respiratory depression, side effects of parenteral drugs, associated with the above said methods can be avoided. Routine post operative monitoring would suffice.

Spinal adjuvants increases the duration of postoperative analgesia, reduces intraoperative side effects of local anaesthetics, lessens the duration of motor block promoting early ambulation. Though many newer adjuvants are available, opioids are still in common use.

Fentanyl, a synthetic opioid agonist, by acting on mu opioid receptors provides dense spinal blockade and local anaesthetic sparing effect. It can be used intrathecally in the range of 5 – 25 microgram.

In our study, the addition of 15 microgram of fentanyl to levobupivacaine improves the onset and duration of sensory blockade with early reversal of motor blockade. The maximum level of blockade is T4 in group LF, whereas it is only T6 in group L . This may lead to low concentration of levobupivacaine per segment in group LF than compared to group L and therefore during reversal, this could have attributed to early regression of motor block in group LF and hence early recovery from motor blockade.The onset of complete motor block is sooner when compared with plain levobupivacaine group.

The time for first analgesic requirement is also increased with minimal side effect. Though there is no statistically significant difference between the two groups in terms of hemodynamic variables, in levobupivacaine with fentanyl group, in a few patients, we observed a fall in BP once. This was treated with intravenous ephedrine and crystalloids, after which the blood pressure was stable. In our study, the amount of levobupivacaine used is the same, that is 10mg in both groups unlike in other studies, where upon addition of spinal adjuvants, the amount of local anaesthetic agent is reduced.

**Yvonne lim** [26] et al evaluated the addition of 25microgram of fentanyl to 2.5mg of 0.5% levobupivacaine in combined spinal epidural technique for labor analgesia. One group received intrathecal 2.5mg levobupivacaine and the other group received the same amount of levobupivacaine with 25 microgram fentanyl followed by 10ml/hr infusion of 0.125% levobupivacaine and 2µg/ml fentanyl. The proportion of patients who delivered without breakthrough pains, the duration of analgesia, characters of sensory and motor block, pain scores, post block side effects were evaluated. Parturients not requiring supplemental analgesia and with prolonged duration of analgesia were seen in levobupivacaine with fentanyl group.

The mean duration of analgesia was 530 minutes fentanyl group when compared to 361 minutes in plain levobupivacaine group.

**Ilkben gunusen** et al performed combined spinal epidural in 120 parturients undergoing caesarean section. Block characteristics, hemodynamic variables, patient and surgeon satisfaction, clinical efficacy of three different doses of levobupivacaine 5mg, 7.5mg, 10mg combined with 25, 15, 10 microgram fentanyl respectively. 100% effective anaesthesia was noted in 10mg levobupivacaine group which provided long duration of analgesia and motor block, with greater patient and surgeon satisfaction. Incidence of side effects like hypotension was in 10mg levobupivacaine group.

In our study, we have used 10 mg levobupivacaine in both groups. Even though the results are quite similar, duration of motor block was shorter in levobupivacaine with fentanyl group. There was statistical difference between our case and control group with a p value of 0.000. The mean duration of motor block is 116.33±4.5minutes in levobupivacaine with fentanyl group and is 152.75±9.4 minutes in levobupivacaine group.

**Bouvet et al** [27] conducted a prospective randomised study to estimate the ED50 and ED 95 of intrathecal levobupivacaine combined with either 100µg morphine or 12.5µg sufentanil in a combined spinal epidural technique. Five dose groups of levobupivacaine 6, 8, 10, 12, 14mg were employed.

A sensory blockade of T6 within 15 minutes of intrathecal injection with no further epidural supplementation was considered successful and the dose which provides it was considered successful. The ED50 and ED95 was found to be 6.2mg and 12.9mg respectively. With doses higher than this, the duration of motor block was higher. Complication rates and hemodynamic stability were similar in both groups. On combining with opioids, the ED95 is 12.9 mg. When doses less than ED95 are used, a combined spinal epidural technique must be employed. In our study,we fixed the dose of levobupivacaine as 10mg used intrathecally, which is close to ED95 dose of levobupivacaine, as estimated by the above study.

From time immemorial, racemic hyperbaric bupivacaine is being used as spinal anaesthetic drug for caesarean section. There are many local anaesthetic agents with good clinical profile such as hemodynamic stability, low cardiovascular and central nervous system toxicity.

One such agent is S-enantiomer of bupivacaine, levobupivacaine**.** **Dorothee H. Bremerich et al** compared 10 mg of 0.5% hyperbaric levobupivacaine with 10mg of 0.5% hyperbaric bupivacaine combined with 10, 20 µg fentanyl or sufentanil 5µg for spinal anaesthesia for caesarean section. Motor block duration was shorter and less pronounced in levobupivacaine group.

Complete motor block of grade bromage 3 occured only in 5 out of 30 parturients when compared to 21 patients in bupivacaine group. This is in contrast to our study, where we observed complete motor block of grade bromage 3 in both group L and group LF, though the two groups differed in motor onset characteristics.

**Nesrin Bozdogan et al** [(28)] compared the effect of addition of opioids, either 2.5µg sufentanil or 10µg fentanyl to 2.2ml of 0.5% levobupivacaine group to a total volume of 3ml with a control group, levobupivacaine. Sufentanil group was better in terms of sensory and motor block characteristics with high incidence of pruritus and surgeon satisfaction score. Neonatal assessment in terms of apgar scoring was comparable in both groups.

Motor onset time happend to be 3 minutes in fentanyl group. Our study showed presence of pruritus in group LF only with a p value of 0.011. Apgar scores were identical in both group L and group LF. Also the motor onset time was 2.70±0.46 minutes in group LF. **Glaser et al** and **Burke et al** reported motor onset time of 10 minutes and 15 minutes in plain levobupivacaine group, respectively. In our study. It took 5.75±0.84 minutes for complete motor block in group L.

In our study we had fixed the dose of levobupivacaine as 10mg, since the minimum effective local anaesthetic dose for levobupivacaine is 11.7mg and subarachnoid block dose range is 7.5 – 10 mg. **Turkmen et al**[29]compared the anaesthetic effects 7.5 mg of 0.5% bupivacaine and levobupivacaine, each combined with 15µg fentanyl in spinal anaesthesia for caesarean section. Onset of sensory and motor block is rapid in bupivacaine group than levobupivacaine group. The duration of analgesia was 118 minutes in levobupivacaine with fentanyl group. In our study,with a similar dose of fentanyl, a dose of 10mg of levobupivacaine provided analgesia for a period of 179.90±6.953 minutes, in comparison with 7.5mg of levobupivacaine in the above study. Increasing the dose of levobupivacaine had increased the duration of postoperative analgesia.

Since many studies have established the low cardiovascular and central nervous system toxicity profile of levobupivacaine, it could be a better alternative to bupivacaine for spinal anaesthesia in caesarean section. **Gulen guler et al** [30] compared the block characters, side effects, hemodynamic changes in two groups. Group LF were given 10mg of 0.5% isobaric levobupivacaine and group BF received 10mg of 0.5% hyperbaric bupivacaine combined with 15µg fentanyl. Sensory onset was 2±0.37minutes, 2 segment regression time was 71.43±12.96 minutes, onset time for motor block was 4.1±0.88 minutes in group LF.

In our study, group LF with similar dose of levobupivacaine and fentanyl, showed a sensory onset time of 2.28±0.452minutes and 2 segment regression time was 95.60±6.559 minutes with an onset of motor block of 2.70±0.464 minutes. Our study is comparable with the above study in terms of sensory onset time.

Caesarean section done under spinal anaesthesia requires a sensory block height of T5. **Subasi et al** compared block characteristics and hemodynamic variables in 80 patients subjected to caesarean section under spinal anaesthesia, of 40 each. Group BF received 7.5mg hyperbaric bupivacaine and group LF received 7.5mg levobupivacaine , both combined with 25µg fentanyl.

Group LF showed a block height of T2 – T4, whereas group BF showed a block heght of T3 –T4. Even in our study, we observed a maximum block height of T4 consistently in group LF. Group L showed a maximum block height of T6. Addition of fentanyl has led to a maximum block height greater than that found in plain levobupivacaine group.

**Prabha et al** compared the hemodynamic effects, sensory and motor block characteristics by administering 8.75mg of 0.5% bupivacaine and fentanyl 12.5µg intrathecally to group B and 8.75mg of 0.5% levobupivacaine with 12.5µg fentanyl to group L in 40 patients of 20 each. Stable hemodynamics, prolonged sensory blockade are the features observed by the above study in group L. Hence it is recommended by them for spinal anaesthesia in caesarean section. Time for complete motor recovery in group L is observed 109.50±16.37 minutes. In our study, where we have used 10mg of 0.5% levobupivacaine with 15µg fentanyl, we have observed time for complete motor reversal as 116.33±4.543 minutes.

# SUMMARY

# SUMMARY

This study titled **" COMPARISON OF INTRATHECAL LEVOBUPIVACAINE AND LEVOBUPIVACAINE WITH FENTANYL IN CAESAREAN SECTION"** was conducted at Mahatma Gandhi Memorial Government Hospital, Trichy, between the years August 2012 to April 2014.

40 patients belonging to age group 18 to 35 years, ASA 1 and 2 were selected. Patients with body weight more than 80 kg, height <150 kg , refusal for spinal anaesthesia, those with spinal deformities and postspinal surgeries, history of allergy to drugs, bleeding disorder, those patients with IUGR, PROM were excluded from the study.

**Our study sample were divided into two group of 40 each.**

1. Group L: Patients received 10mg of 0.5% levobupivacaine combined with 0.3ml normal saline.
2. Group LF: Patients received 10mg of 0.5% levobupivacaine combined with 0.3ml (15µg) fentanyl.

Sensory block characteristics like onset, two segment regression, maximum block height, duration of effective analgesia were noted. Motor block characteristics like onset of motor block and complete motor recovery were monitored. Hemodynamic parameters like pulse rate, blood pressure, oxygen saturation were noted both intraoperatively and postoperatively.

Total ephedrine usage, sedation status of patients assessed by modified ramsay sedation scale, postoperative analgesia assessed by visual analogue score, duration of surgery, incidence of complications like nausea and vomiting, hypotension, Pruritus, respiratory depression, bradycardia, neonatal assessment by apgar score were assessed and compared.

In this prospective, double blind, randomised control study, the following results were noted:

1. Both the groups L and LF were comparable in terms of age, weight, height, ASA status, duration of surgery.
2. Early onset of sensory blockade, prolonged duration of effective analgesia were noted in group LF.
3. Early onset of motor blockade with early reversal of motor block (motor recovery) were observed in group LF.
4. Incidence of complications like hypotension, pruritus, nausea and vomiting were relatively high in group LF.
5. Both the groups showed no significant changes in neonatal outcome in terms of apgar.

# CONCLUSION

# CONCLUSION

Addition of intrathecal fentanyl 15µg to 10 mg of 0.5% levobupivacaine in caesarean section shortens the onset of sensory and motor block, prolongs the duration of postoperative analgesia with early motor recovery. Incidence of pruritus, hypotension, nausea and vomiting were relatively high in levobupivacaine with fentanyl group, though not warranting any specific treatment. There was no statistical difference in terms of hemodynamic variables between both groups. Apgar scoring of neonates were comparable in both groups and no adverse effects were noted among neonates in both groups.

# BIBILIOGRAPHY

# BIBLIOGRAPHY


1. David O.Gorman, David J.Birnbach. Neural blockade for obstetrics and gynaecologic surgery. Michael J.Cousins, Daniel B.Carr editors. Neural Blockade in clinical anaesthesia and pain medicine. 4th edn. Newyork: Lippincott Williams &Wilkins. 2009. P. 549-50.
2. Merlin D.Larson. History of anesthetic practice. Ronald D.Miller editor. Miller´s Anesthesia. 7th edn. Philadelphia: Churchil Livingston Elsevier. 2010. P.13.
3. Wayne kieinman, MD, Maged Mikhail, MD. Spinal, Epidural, & Caudal blocks. G.Edward Morgan,MD editor. Clinical Anesthesiology. 4th edn. Newyork: Tata McGraw-Hill. 2012. P.291-95.
4. Harold Ellis. The Vertebral canal and its contents. Stanley Feldman editor. Anatomy for Anaesthetist. 8th edn. USA: Blackwell science. 2004. P.120.
5. Robert Gaiser. Physiologic changes of Pregnancy. David H.Chestnut, MD, editor. Obstetric Anesthesia: Principles and Practice. 4th edn. Philadelphia: Mosby Elsevier. 2009. P.26.
6. Robert Gaiser. Physiologic changes of Pregnancy. David H.Chestnut, MD, editor. Obstetric Anesthesia: Principles and Practice. 4th edn. Philadelphia: Mosby Elsevier. 2009. P.16-24.

7. William F.Ganong MD. Circulation through special regions. William F.Ganong editor. Review of Medical Physiology. 20th edn. USA: McGraw-Hill. 2001. P.590.
8. Quinn H.Hogan. Anatomy of the Neuraxis. Michael J.Cousins editor. Neural Blockade in clinical anesthesia and pain medicine. 4th edn. Philadelphia: Lippincott Williams & Wilkins. 2009. P.191-92.
9. G.Edward Morgan. Pain management. Maged S.Mikhail editor. Clinical Anesthesiology. 4th edn. Newyork: Tata McGraw-Hill. 2012. P.372.
10. David O.Gorman, David J.Birnbach. Neural blockade for obstetrics and gynaecologic surgery. Michael J.Cousins, Daniel B.Carr editor. Neural Blockade in clinical anaesthesia and pain medicine. 4th edn. Newyork: Lippincott Williams &Wilkins. 2009. P.545.
11. Robert K.Stoelting. Opioid agonist and antagonist. Simon C.Hillier editor. Pharmacology and Physiology in Anesthetic Practice. 4th edn. USA: Lippincott Williams & Wilkins. 2006. P.104-108.
12. Alan C.Santos,MD , Brenda A.Bucklin,MD. Local Anesthetics and Opioids. David H.Chestnut editor. Obstetric Anesthesia: Principles and Practice. 4th edn. Philadelphia: Mosby Elsevier. 2009. P.270-71.
13. Alan C.Santos,MD , Brenda A.Bucklin,MD. Local Anesthetics and Opioids. David H.Chestnut editor. Obstetric Anesthesia: Principles and Practice. 4th edn. Philadelphia: Mosby Elsevier. 2009. P.270.

14. Hamdy M. Shokr, M.D EFFECT OF INTRATHECAL FENTANYL ON ALERTNESS. Ains sham Journal of Anesthesiology. Vol 4-3; Oct 2011; 117-126.

15. Nelson, Kenneth E. M.D. Rauch, Traci M.D. Terebuh, Victor M.D.; D'Angelo, Robert M.D. A Comparison of Intrathecal Fentanyl and Sufentanil for Labor Analgesia. Anesthesiology: May 2002 - Volume 96 - Issue 5 - pp 1070-1073.

16. Alan C.Santos,MD , Brenda A.Bucklin,MD. Local Anesthetics and Opioids. David H.Chestnut editor. Obstetric Anesthesia: Principles and Practice. 4th edn. Philadelphia: Mosby Elsevier. 2009. P.270.

17. SHAHRIARI A AND KHOOSHIDEH M INTRATHECAL FENTANYL ADDED TO LIDOCAINE FOR CESAREAN DELIVERY UNDER SPINAL ANESTHESIA A Randomised Clinical Trial - M.E.J. ANESTH 19 (2), 2007.

18. Gonzalez Cardenas Neonatal Respiratory Depression and Intrathecal Fentanyl. Rev Colombian journal of Anesthesiology. 2012;40(2):100-105.

19. Dilek Yazicioglu, Taylan Akkaya, Ercan Sonmez, Haluk Gumus Addition of lidocaine to levobupivacaine reduces intrathecal block duration: randomized controlled trial Rev. Bras. Anestesiol. vol.64 no.3

20. Cappelleri, Gianluca MD; Aldegheri, Giorgio MD; Danelli, Giorgio MD; Marchetti, Chiara MD; Nuzzi, Massimiliano MD; Iannandrea, Gabriella MD; Casati, Andrea MD Spinal Anesthesia with Hyperbaric Levobupivacaine and Ropivacaine for Outpatient Knee Arthroscopy: A Prospective, Randomized, Double-Blind Study Anesthesia & Analgesia: July 2005 - Volume 101 - Issue 1 - pp 77-82
21. F. Erdil, S. Bulut, S. Demirbilek, E. Gedik, N. Gulhas and M. O. Ersoy. The effects of intrathecal levobupivacaine and bupivacaine in the elderly. Journal of the association of the anaesthetists of great Britain and Ireland -Anaesthesia, 2009, 64, pages 942–946
22. Ashton Dionel D'Souza1, Nichelle Mrinali Saldanha, Ashma Dorothy Monteiro, Harshavardhan. Comparison of Intrathecal Hyperbaric 0.5% Bupivacaine, Isobaric 0.5% Levobupivacaine and Isobaric 0.75% Ropivacaine for Lower Abdominal Surgeries. International Journal of Health Sciences and Research ISSN: 2249-9571.
23. Y. Y. Lee , K. Muchhal , C. K. Chan and A. S. P. Cheung. Levobupivacaine and fentanyl for spinal anaesthesia: a randomized trial European journal of Anesthesiology / Volume / Issue 12 / December 2005, pp 899-903.
24. Hazel Bardsley, Robert Gristwood, Helen Baker, Norma Watson, and Walter Nimmo A comparison of the cardiovascular effects of levobupivacaine and rac-bupivacaine following intravenous

administration to healthy volunteers Br J Clin Pharmacol. Sep 1998; 46(3): 245–249.

25. Indumathi. , Manjula. , Sangeetha. , Vasundhara. Comparative Study of Intrathecal Ropivacaine and Levobupivacaine With Fentanyl And Magnesium As Adjuvants For Lower Abdominal Surgeries. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 13, Issue 5 Ver. II. (May. 2014), PP 39-43.

26. Yvonne Lim, Alex T. Sia, Cecilia E. Ocampo Comparison of intrathecal levobupivacaine with and without fentanyl in combined spinal epidural for labor analgesia. Med Sci Monit, 2004; 10(7): PI87-91.

27. L.Bouvet, X.Da-Col, D.Chassard, F.Dale, L.Ruynat, B.Allaouchiche, E.Dantony and E.Boselli. ED50 and ED95 of intrathecal levobupivacaine with opioids for Caesarean delivery. British Journal of Anaesthesia 106 (2): 215–20 (2011)

28. Nesrin Bozdogan Ozyilkan, MD, Aysu Kocum, MD, Mesut_Sener, MD, Esra Caliskan, MD, Ebru Tarim, MD, Pinar Ergenoglu, MD, and Anis Aribogan, MDComparison of Intrathecal Levobupivacaine Combined with Sufentanil, Fentanyl, or Placebo for Elective Caesarean Section: A Prospective, Randomized, Double-Blind,

Controlled Study. Current Therapeutic Research Clinical and Experimental. Dec 2013; 75: 64–70.

29. Turkmen A, Moralar DG, Ali A, Altan A. Comparison of the anesthetic effects of intrathecal levobupivacaine + fentanyl and bupivacaine + fentanyl during caesarean section. Middle East Journal of Anesthesiology. 2012 Feb;21(4):577-82.

30. Gulen Guler, Gokhan Cakir, Ayşe Ulgey, Fatih Ugur, Cihangir Bicer, Isın Gunes, Adem Boyaci. A Comparison of Spinal Anesthesia with Levobupivacaine and Hyperbaric Bupivacaine for Cesarean Sections: A Randomized Trial. Open Journal of Anesthesiology, 2012, 2, 84-89.

# ANNEXURES

# PROFORMA

**Comparison of intrathecal levobupivacaine and levobupivacaine with fentanyl in lscs.**

Patient name: Age/Sex: IP. No:

Duration of Surgery: ASA status: Date:

Height: Weight: Time of SAB:

GROUPS:

Group L- 0.5% levobupivacaine 10mg + 0.3ml normal saline

Group LF- 0.5% levobupivacaine 10mg + 0.3ml fentanyl

Position of patient:

Baby delivery time:

The following observations are made at one minute interval until baby delivery,

every 5 minutes interval until the end of surgery, and every 15 minutes interval

until the observation for sensory and motor block endpoints.

| Time(minutes) | Sensory blockade | Motor blockade | SBP | DBP | SpO2 | Level of blockade | RSS | Complication | Drug | Apgar |
|---|---|---|---|---|---|---|---|---|---|---|
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## POSTOPERATIVE MONITORING

| Time | Pulse | BP | $SpO_2$ | Pain score(VAS) | Ramsay score | Remarks |
|---|---|---|---|---|---|---|
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Both mother and neonate were followed  24 hours for any complications.

**RESULTS**

1. Time to reach T8-
2. Highest sensory block height-
3. Time to reach bromage grade 3-
4. Time taken for 2 segment regression-
5. Time taken to reach T12-
6. Time taken to reach bromage grade 0(recovery)-
7. Time of rescue analgesia-
8. Apgar at one minute and 5 minute-

# நோயாளி சம்மதக் கடிதம்.

மகப்பேறு காலத்தில் ஏதேனும் காரணத்தினால் அறுவை சிகிச்சை செய்து குழந்தையை எடுப்பதற்கு முதுகில் சிறிய ஊசி மூலம் மருந்து செலுத்தி மயக்க மருந்து கொடுக்கப்படும். பொதுவாக பூபிவேக்கன் (Bupivacaine) என்னும் மருந்து செலுத்தி மயக்க மருந்து கொடுக்கப்படும். உங்களை ஈடுபடுத்த திட்டமிடப்பட்டுள்ள இந்த மருத்துவ ஆராய்ச்சியில் மேற்கூறிய மருந்திற்கு மாற்றாக லிவோபுபிவேக்கன் (Levobupivacaine) மற்றும் ஃவெண்டனில் (Fentanyl) எனும் மருந்தை உபயோகிக்க திட்டமிடப்பட்டுள்ளது. Bupivacaine-யினால் ஏற்படும் இரத்த அழுத்தம், நாடித்துடிப்பு, இருதயம் மற்றும் நரம்பு மண்டல செயல்படுகளில் ஏற்படும் பாதிப்பு Levobupivacaine மருந்தில் மிகவும் குறைவு.

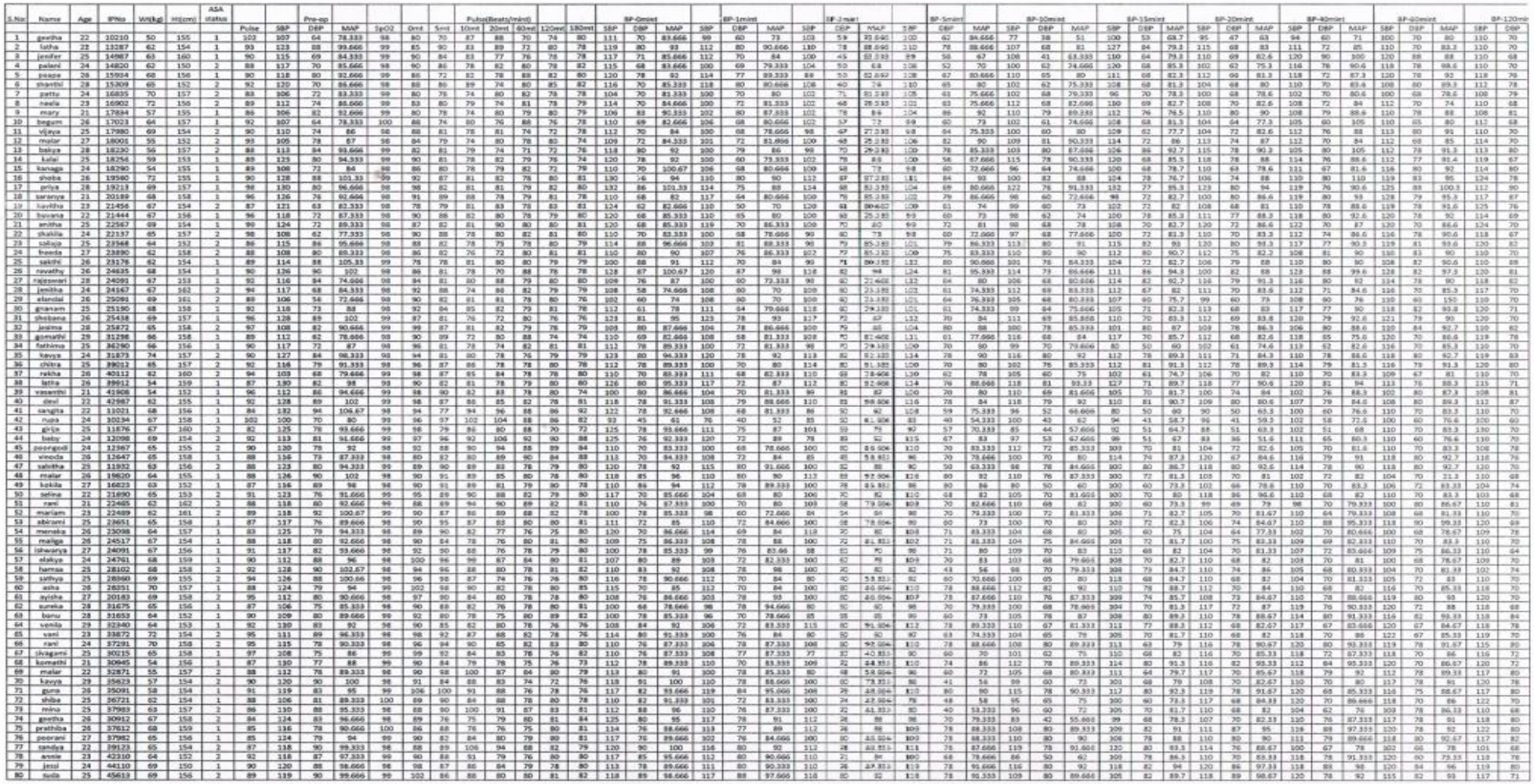
அனைத்து மருத்துவ முறைகளில் இருப்பது போலவே இம்மருத்துவ முறையிலும் எதிர்பாரா இடர்பாடுகள் நேரிடலாம்.

உங்கள் மருத்துவ பதிவேடுகள் மிகவும் அந்தரங்கமாக வைத்து கொள்ளப்படும். இந்த ஆய்வு முடிவுகள் அறிவியல் பத்திரிக்கைகளில் பிரசுரிக்கப்படலாம். ஆனால் உங்கள் இரகசியத் தன்மை பாதுகாக்கப்படும். இந்த ஆய்விலிருந்து தாங்கள் எந்த நேரமும் காரணமில்லாமல் விலகி கொள்ளலாம். எப்படியிருந்தாலும் தேவையான சிகிச்சை அளிக்கப்படும்.

மேற்கூறிய மருத்துவ தகவல்களை இந்த ஆய்வினை மேற்கொள்ளும் மருத்துவர் மூலம் அறிந்து நான் தன்னிச்சையாக இந்த ஆய்வில் பங்கேற்கிறேன். இந்த ஆய்வு சம்மந்தமாகவோ, இதை சார்ந்த மேலும் மேற்கொள்ளும் மற்ற ஆய்வுகளில் பங்கேற்கும் மருத்துவர் என் மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதி தேவையில்லை என்பதை அறிவேன். எனது மற்றும் எனது குழந்தையின் நலன் கருதியே இந்த ஆய்வு மேற்கொள்ளப்படுகிறது என்று தெரிந்து இந்த ஆய்விற்கு சம்மதிக்கிறேன்.

கையொப்பம்
(அல்லது)
இடது கட்டைவிரல் கைநாட்டு

# MASTER CHART



| ID | BP-[BP+map] | | | Ephedrine | | | | Sensory | | Motor | | | | | BSS | | | | | VAS | | | APGAR | APGAR | Rescue | DOS | Adv. Effects | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASP | SBP | DBP | MBP | Onset | Ultrax bloc | 2 seg regrsg | to T10 | Onset | recovery | 30mi | 60mc | 90mi | 120mi | 150mi | 180mi | 210mi | 240mi | 90-120mi | 121-150mi | 151-180mi | 1mi | 5mi | analgesia | (mB) | NOV | HypoT | Brady | Resp.dep | pruritus | |
| 88.3 | 130 | 20 | 80 | Ephedrine | 4 | T8 | 145 | 180 | 6 | 165 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 2 | 4 | 8 | 8 | 165 | 30 | Y | Y | | | | |
| 85.3 | 130 | 20 | 80.3 | | 5 | T8 | 139 | 145 | 7 | 100 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 140 | 34 | | | | | | |
| 82 | 130 | 20 | 80.3 | Ephedrine | 5 | T8 | 80 | 112 | 5 | 160 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 3 | | | 8 | 8 | 120 | 38 | Y | Y | | | | |
| 85.3 | 130 | 20 | 80.3 | | 4 | T8 | 85 | 140 | 5 | 150 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 3 | 4 | | 9 | 9 | 122 | 32 | | | | | | |
| 90 | 126 | 80 | 90 | Ephedrine | 4 | T8 | 78 | 134 | 7 | 156 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 134 | 29 | | Y | | | | |
| 89.133 | 128 | 29 | 90 | | 4 | T8 | 84 | 118 | 5 | 160 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 3 | 3 | | 8 | 8 | 125 | 40 | | | | | | |
| 88.600 | 120 | 20 | 80.3 | | 5 | T8 | 70 | 138 | 6 | 158 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 8 | 8 | 130 | 45 | | | | | | |
| 82 | 130 | 20 | 80.3 | | 5 | T8 | 88 | 130 | 5 | 157 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 9 | 8 | 122 | 36 | | | | | | |
| 90 | 122 | 29 | 90 | | 4 | T8 | 74 | 128 | 6 | 156 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 9 | 136 | 35 | | | | | | |
| 89.133 | 122 | 25 | 87.58 | | 4 | T8 | 74 | 132 | 5 | 150 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 134 | 37 | | | | | | |
| 88.133 | 124 | 81 | 90 | | 4 | T8 | 82 | 130 | 7 | 148 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 125 | 32 | | | | | | |
| 84.600 | 126 | 80 | 90 | | 4 | T8 | 79 | 135 | 6 | 147 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 130 | 33 | | | | | | |
| 90 | 120 | 69 | 92.086 | | 5 | T8 | 68 | 138 | 5 | 150 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 9 | 132 | 35 | | | | | | |
| 84.133 | 124 | 28 | 80 | | 4 | T8 | 78 | 136 | 5 | 152 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 9 | 9 | 129 | 35 | | | | | | |
| 91.133 | 126 | 28 | 80.586 | | 4 | T8 | 79 | 132 | 5 | 158 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 8 | 8 | 133 | 36 | | | | | | |
| 93.133 | 122 | 26 | 81.333 | | 4 | T8 | 68 | 138 | 6 | 155 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 140 | 37 | | | | | | |
| 97.133 | 120 | 80 | 93.333 | | 5 | T8 | 65 | 116 | 7 | 159 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 3 | 4 | | 8 | 8 | 123 | 35 | | | | | | |
| 87 | 124 | 66 | 86.086 | | 4 | T8 | 78 | 112 | 7 | 154 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 125 | 36 | | | | | | |
| 92.133 | 125 | 26 | 90.333 | | 4 | T8 | 79 | 130 | 6 | 158 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 8 | 9 | 137 | 34 | | | | | | |
| 88 | 129 | 69 | 90.333 | | 5 | T8 | 67 | 132 | 7 | 160 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 4 | | 8 | 8 | 142 | 37 | | | | | | |
| 88 | 120 | 20 | 85.086 | | 5 | T8 | 69 | 118 | 5 | 148 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 9 | 9 | 127 | 36 | | | | | | |
| 88 | 120 | 20 | 85.086 | | 4 | T8 | 79 | 138 | 5 | 160 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 3 | | 8 | 8 | 121 | 30 | | | | | | |
| 94.600 | 120 | 81 | 94 | | 4 | T8 | 80 | 118 | 6 | 155 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 139 | 32 | | | | | | |
| 88.8 | 120 | 20 | 88.8 | | 4 | T8 | 79 | 140 | 5 | 158 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 121 | 37 | | | | | | |
| 95.133 | 124 | 67 | 92.333 | | 5 | T8 | 69 | 118 | 7 | 154 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 4 | | 8 | 9 | 134 | 38 | | | | | | |
| 98 | 127 | 26 | 83.086 | | 5 | T8 | 68 | 135 | 5 | 154 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 4 | | 9 | 9 | 137 | 39 | | | | | | |
| 96 | 128 | 28 | 88.333 | | 5 | T8 | 68 | 138 | 6 | 148 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 8 | 8 | 138 | 38 | | | | | | |
| 87.55 | 123 | 68 | 88 | | 4 | T8 | 68 | 140 | 5 | 157 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 138 | 35 | | | | | | |
| 88.3 | 120 | 20 | 89.333 | | 4 | T8 | 69 | 148 | 7 | 155 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 138 | 37 | | | | | | |
| 87.133 | 120 | 20 | 86.086 | | 4 | T8 | 78 | 138 | 6 | 158 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 3 | | 8 | 9 | 129 | 36 | | | | | | |
| 86.600 | 120 | 20 | 80.086 | | 4 | T8 | 80 | 132 | 6 | 157 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 3 | | 8 | 8 | 127 | 36 | | | | | | |
| 91.133 | 126 | 64 | 92.066 | | 4 | T8 | 88 | 132 | 5 | 157 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 8 | 9 | 133 | 37 | | | | | | |
| 91.666 | 126 | 26 | 89.333 | | 4 | T8 | 67 | 135 | 5 | 147 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 4 | | 8 | 8 | 137 | 34 | | | | | | |
| 88.133 | 122 | 28 | 88.333 | Ephedrine | 5 | T8 | 80 | 138 | 5 | 148 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 8 | 129 | 35 | Y | Y | | | | |
| 96 | 120 | 20 | 80.666 | | 5 | T8 | 83 | 138 | 7 | 156 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | | 8 | 9 | 125 | 37 | | | | | | |
| 93.133 | 120 | 81 | 94 | | 5 | T8 | 75 | 139 | 7 | 158 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 3 | | 9 | 9 | 138 | 38 | | | | | | |
| 83.133 | 120 | 20 | 80.3 | | 4 | T8 | 68 | 139 | 5 | 155 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 4 | | 9 | 8 | 138 | 35 | | | | | | |
| 83.600 | 124 | 67 | 90.333 | | 4 | T8 | 79 | 139 | 5 | 158 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 1 | 4 | | 8 | 8 | 134 | 36 | | | | | | |
| 90 | 130 | 82 | 98.333 | | 4 | T8 | 79 | 112 | 5 | 160 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 8 | 8 | 139 | 36 | | | | | | |
| 95.133 | 123 | 66 | 95.333 | | 5 | T8 | 80 | 138 | 5 | 158 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 4 | | 8 | 9 | 132 | 36 | | | | | | |
| 83.133 | 120 | 20 | 83.333 | Ephedrine | 2 | T8 | 90 | 135 | 3 | 130 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 4 | 8 | 8 | 170 | 37 | | Y | | | | Y |
| 74.600 | 120 | 20 | 83.333 | Ephedrine | 2 | T8 | 85 | 135 | 2 | 105 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 9 | 180 | 36 | Y | Y | | | | |
| 90 | 126 | 20 | 88.086 | Ephedrine | 2 | T8 | 90 | 200 | 3 | 120 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 4 | 8 | 8 | 200 | 38 | | Y | | | | |
| 83.133 | 128 | 20 | 87.40 | Ephedrine | 3 | T8 | 80 | 180 | 3 | 138 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 165 | 38 | Y | Y | | | | |
| 88 | 122 | 26 | 88.333 | | 2 | T8 | 90 | 180 | 3 | 130 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 4 | 9 | 9 | 170 | 34 | | | | | | |
| 90 | 129 | 80 | 93 | Ephedrine | 2 | T8 | 88 | 188 | 3 | 138 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 4 | 8 | 8 | 177 | 33 | | Y | | | | |
| 84.600 | 123 | 26 | 88.333 | Ephedrine | 2 | T8 | 96 | 182 | 3 | 134 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 4 | 8 | 8 | 182 | 36 | | Y | | | | |
| 82 | 122 | 20 | 84 | | 3 | T8 | 100 | 168 | 3 | 137 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 9 | 176 | 29 | | | | | | Y |
| 88 | 122 | 26 | 88 | Ephedrine | 3 | T8 | 97 | 180 | 3 | 120 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 9 | 172 | 40 | Y | Y | | | | |
| 79.600 | 126 | 20 | 82.086 | | 2 | T8 | 98 | 178 | 2 | 130 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 174 | 38 | | | | | | |
| 90.600 | 122 | 23 | 86.333 | | 2 | T8 | 98 | 168 | 2 | 150 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 9 | 171 | 34 | | | | | | |
| 83.133 | 123 | 68 | 91.086 | Ephedrine | 3 | T8 | 88 | 182 | 2 | 125 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 169 | 35 | | Y | | | | |
| 86 | 127 | 80 | 92.333 | | 3 | T8 | 98 | 186 | 3 | 134 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 4 | 8 | 9 | 179 | 36 | | | | | | |
| 88.133 | 130 | 22 | 89.044 | | 3 | T8 | 88 | 188 | 2 | 120 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 4 | 8 | 8 | 180 | 37 | | | | | | |
| 85.8 | 125 | 22 | 89 | | 2 | T8 | 89 | 188 | 3 | 135 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 4 | 8 | 8 | 181 | 36 | | | | | | |
| 79.133 | 129 | 22 | 84.333 | Ephedrine | 2 | T8 | 90 | 190 | 3 | 135 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 4 | 8 | 8 | 182 | 37 | | Y | | | | |
| 88 | 130 | 20 | 85.333 | | 2 | T8 | 100 | 180 | 3 | 130 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 4 | 8 | 8 | 170 | 32 | | | | | | Y |
| 83.133 | 129 | 21 | 85.086 | Ephedrine | 2 | T8 | 107 | 190 | 3 | 182 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 9 | 178 | 35 | | Y | | | | |
| 83.133 | 125 | 22 | 90.086 | Ephedrine | 2 | T8 | 130 | 188 | 2 | 187 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 179 | 35 | Y | Y | | | | |
| 86 | 134 | 29 | 90.086 | | 2 | T8 | 105 | 178 | 3 | 188 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 8 | 182 | 37 | | | | | | |
| 84.600 | 125 | 68 | 88.086 | | 2 | T8 | 97 | 172 | 3 | 188 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 183 | 36 | | | | | | |
| 84.600 | 132 | 20 | 84 | Ephedrine | 2 | T8 | 98 | 172 | 2 | 188 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 186 | 45 | Y | Y | | | | |
| 95.133 | 126 | 82 | 90.333 | Ephedrine | 3 | T8 | 98 | 180 | 2 | 180 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 8 | 179 | 37 | | Y | | | | |
| 91.133 | 126 | 26 | 80.666 | | 3 | T8 | 88 | 188 | 3 | 180 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 8 | 185 | 38 | | | | | | |
| 86.133 | 127 | 68 | 87.333 | Ephedrine | 3 | T8 | 90 | 189 | 3 | 182 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 9 | 184 | 38 | | Y | | | | |
| 91.666 | 119 | 81 | 93.666 | | 2 | T8 | 96 | 170 | 3 | 188 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 9 | 8 | 188 | 34 | | | | | | |
| 86.600 | 124 | 28 | 80.666 | Ephedrine | 2 | T8 | 97 | 170 | 3 | 188 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 189 | 36 | Y | Y | | | | Y |
| 48 | 122 | 28 | 87.333 | | 2 | T8 | 97 | 180 | 3 | 185 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 188 | 37 | | | | | | |
| 92.133 | 120 | 28 | 85.086 | Ephedrine | 2 | T8 | 98 | 188 | 3 | 185 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 8 | 179 | 33 | | Y | | | | |
| 98 | 125 | 69 | 84.333 | Ephedrine | 2 | T8 | 99 | 188 | 3 | 185 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 4 | 8 | 8 | 175 | 35 | | Y | | | | |
| 82.133 | 122 | 88 | 98 | | 3 | T8 | 100 | 190 | 3 | 184 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 9 | 188 | 36 | | | | | | |
| 87.133 | 127 | 87 | 92 | Ephedrine | 2 | T8 | 108 | 187 | 3 | 184 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 9 | 9 | 188 | 35 | Y | Y | | | | Y |
| 82 | 132 | 25 | 90 | Ephedrine | 2 | T8 | 100 | 178 | 2 | 184 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 3 | 3 | 9 | 9 | 183 | 37 | | Y | | | | |
| 92.600 | 127 | 82 | 98.666 | Ephedrine | 2 | T8 | 99 | 178 | 2 | 188 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 178 | 35 | Y | Y | | | | |
| 98 | 128 | 28 | 98.333 | | 2 | T8 | 99 | 180 | 2 | 180 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 8 | 189 | 37 | | | | | | Y |
| 93.666 | 128 | 80 | 92 | | 2 | T8 | 98 | 178 | 3 | 182 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 4 | 8 | 8 | 179 | 34 | | | | | | |
| 79 | 129 | 20 | 89 | | 3 | T8 | 99 | 248 | 3 | 180 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 8 | 8 | 186 | 33 | | | | | | |
| 91.133 | 134 | 86 | 98.333 | Ephedrine | 2 | T8 | 99 | 248 | 2 | 180 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 175 | 37 | | Y | | | | |
| 98 | 139 | 98 | 98.666 | | 2 | T8 | 99 | 180 | 3 | 188 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 8 | 180 | 34 | | | | | | |
| 86.133 | 120 | 68 | 85.333 | | 2 | T8 | 99 | 185 | 3 | 180 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 3 | 8 | 9 | 177 | 36 | | | | | | Y |

## KEY TO MASTER CHART

| | | |
|---|---|---|
| Wt | - | weight |
| Brady | - | bradycardia |
| Ht | - | height |
| Resp dep | - | respiratory depression |
| SBP | - | systolic blood pressure |
| Y | - | yes |
| DBP | - | diastolic blood pressure |
| MAP | - | mean arterial pressure |
| Max block | - | maximum block height |
| 2 seg reg | - | 2 segment regression |
| Reg to T12 | - | regression to T12 |
| RSS | - | Ramsay sedation score |
| VAS | - | Visual analogue score |
| DOS | - | duration of surgery |
| NOV | - | nausea and vomiting |
| hypoT | - | hypotension |